The Builder.

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Railway Carriages at the Paris Exhibition.

TRAVELLERS who are chiefly acquainted with the French railways from Boulogne and Dieppe to Paris, will naturally arrive at the conclusion that the railway carriages in France are far inferior to those in use even on some of our southern lines; if, however, they visit the railway carriages exhibited in the Paris Exhibition they will have cause to change their views, and to think that a good deal of attention has been paid to the comfort of the passenger on some of the principal Continental railways, notably, we think, on the Paris, Lyons, and Mediterranean Railway, whose exhibit comprises five first-class carriages of various types, and one third-class carriage. The first carriage which comes under our notice is of the first-class, long-bodied, bogie type, with end platforms and entrances, and with a corridor running down the centre, that is to say, there are two seats on one side of the corridor and one on the other. The frames are of plate placed at the outside of the carriage; they are parallel over the bogies, but deeply bellied between them. The bogie frames, which are of H section, are placed between the main frames and inside the wheels. The bogies are 12 ft. 11¾ in. long; they are provided with four wheels each, which are placed 4 ft. 4½ in. apart from centre to centre, the distance between the centres of the bogies being 47 ft. 10⅞ in. The number of sittings provided is forty-seven. There are four compartments, containing sixteen seats, intended for smoking; these compartments are shut off from the rest of the carriage by sliding doors; all the rest of the carriage is open. Two lavatories are provided, and there are two sets of apparatus for heating the carriage with hot water. The lighting is by gas. The length of this carriage over the frames is 73 ft. 4¾ in. Its weight, when empty, is 35 tons 4 cwt.; with fuel and water, 36 tons 6¾ cwt.; and when full, 38 tons 11½ cwt.; and the dead load carried per passenger when the complement is complete is 1,730 lbs.

The ordinary six-wheeled, fixed-wheel base, first-class carriage, is entered from the side; the number of sittings is thirty-two, in four compartments. The length over frames is 33 ft. 2⅞ in.; the weight, empty, is 14 tons 8 cwt., and full, 16 tons 5 cwt.; and the dead load hauled per passenger is 980 lbs.

A somewhat similar carriage to that first described is one in which the corridor is at one side for half the length of the carriage, and on the other for the rest of the distance, a cross gangway at the centre of the length affording access from one to the other. In this carriage all the compartments are provided with sliding doors, and, besides the end entrances, there are doors on the central cross gangway. Two lavatories and two sets of heating apparatus are provided; and the number of seats is forty-eight. The length of this carriage over frames is 76 ft. 3½ in. Its weight, when empty, is 35 tons 18¾ cwt.; when full, 37 tons 7¼ cwt.; and the dead load hauled per passenger is 1,741 lbs.

The sleeping-carriages are two in number, and are entitled respectively, "Fauteuils-Lits," and "Lits-Salon." The first-named is arranged for forty-two seats, and six beds; four lavatories are provided, and four sets of heating apparatus; the entrances are at the sides, and the lavatories are placed between the compartments. Length over frames, 63 ft. 6½ in.; weight, when empty, 34 tons 10½ cwt.; when full, 35 tons 16¼ cwt.; and the dead load hauled per passenger carried is 1,671 lbs.

The "Lits-Salon" is the most luxurious carriage exhibited; it has three compartments only, each about 8 ft. 6 in. square, and in each compartment are three seats, so arranged that at night the backs pull forward and become beds, in which are mattresses; the bed linen is stored behind the seats. A lavatory is provided for each compartment, and the carriage can be heated as desired; the entrances are at the sides. These carriages are carried on six wheels; the length over frames is 35 ft. 2½ in.; the weight empty is 16 tons 15¾ cwt.; when full, 17 tons 19¼ cwt.; and the dead load hauled per passenger carried is 4,366 lbs.

The third-class carriage is of the six-wheeled type; it is divided into five compartments, the divisions of the centre one running to the roof, of the others only half height. The number of seats provided is fifty, the length of the carriage over frames is 29 ft. 6 in. Its weight, when empty, is 10 tons 13¾ cwt.; when full, 14 tons 2¾ cwt.; and the dead load hauled per passenger is 477 lbs.

Let us compare these carriages with those exhibited by the Midland and the North-Western Railway Companies.

The Midland Company's carriage is one of their six-wheeled bogie composite type. There are three first-class and three third-class compartments, besides a compartment for luggage, and one for the guard. There are seats for sixteen first-class and twenty-eight third-class passengers, or forty-four sittings in all. Every compartment, with the exception, strange to relate, of that provided for first-class smoking travellers, has its own lavatory, but no heating apparatus is supplied. The length of the carriage is 56 ft. Its weight, when empty, is 25 tons 3½ cwt.; when full, 29 tons 11½ cwt.; and the dead weight hauled per passenger carried is 1,282 lbs.

The London and North-Western carriage is of the saloon, sleeping, standard type; it is carried on two fixed axles, 16 ft. between centres, and on two axles arranged to swivel from a radius bar, and placed 32 ft. between centres. There are four sleeping apartments, lighted by gas, and heated; two compartments provide accommodation for four, and two for two passengers. There are thus twelve beds in the carriage, and an attendant travels with it. Besides the sleeping accommodation, seats are provided in one of the vestibules for smoking, and there is a separate lavatory for each compartment. The length of the carriage is 42 ft.; weight, when empty, 22 tons; when full, 23 tons 3 cwt.; and the dead weight hauled per passenger carried is 4,107 lbs.

The Chemin de Fer du Nord exhibits a first-class, four-wheeled, sleeping-carriage, divided into three compartments, one of which is an ordinary compartment to hold eight passengers, the other two being sleeping-carriages also designed to carry eight passengers,—sixteen in all. The sleeping compartments communicate by a passage, off which are the lavatories, one for each compartment. The carriage is provided with Prudhomme's electric communication, which also applies the air-brake. The compartments can be warmed as desired. The length of the carriage over frames is 28 ft. 2½ in.; its weight is 12 tons 7 cwt.; the dead weight carried per passenger in the ordinary compartment is 770 lb., and in the sleeping compartments, 2,640 lb.

The sleeping accommodation in this carriage cannot be compared with that of the "Lits-Salon," or of the London and North-Western Railway carriage, as the actual number of beds is only six and two sofas, and the length per passenger is obviously much restricted.

The Paris and Orleans Railway exhibit two

first-class carriages. One is of the ordinary type used on the line, and is made up of four compartments, each to seat eight passengers, thirty-two seats in all. These carriages are lighted by Shallis & Thomas's mineral oil lamps, which burn from twelve to fifteen hours. The length of the carriage is 29 ft., its weight is 11 tons 6½ cwt., and the dead load per passenger is 792 lb. The other carriage exhibited by this Company is of the long-bodied bogie form, with end enclosed entrances and side corridor. The number of seats is forty-two, in seven compartments: the arms between the seats lift up, and the seats can be drawn out so as to form couches. The length of this carriage is 63 ft. 8¼ in., its weight is 32 tons 8¼ cwts., and the dead load per passenger is 1,727 lb.

The exhibit of the Société Anonyme Internationale consist of one first and one third-class carriage of the standard gauge and one second-class carriage adapted to the mètre gauge and of the latest type adopted by the Société Nationale de Chemins de Fer Vicinaux. The first-class carriage is six-wheeled, it is seated for forty passengers, and its length is 38 ft. 5½ in.; the third-class carriage is similar in construction, and seats eighty passengers; its length is 41 ft. 9⅛ in. The first-class carriage is fitted with the Westinghouse, the third-class with a screw brake. These carriages are framed in pitch-pine, the exterior of the first-class carriage being finished in varnished teak. The interior of the same carriage is furnished in the cloth adopted by the Belgian States Railway; the cornices and ceilings are in silk rep, and the whole is relieved with Italian and American walnut mouldings. The third-class carriage is finished in pitch-pine. The second-class carriage has four wheels, with central corridor and end platforms; it is 23 ft. 10⅝ in. long, and is intended to seat twenty-four passengers. The woodwork is varnished teak and pitch-pine inside, and teak and oak painted and varnished outside; there is no upholstery.

The Société Anonyme des Ateliers de Construction de Malines exhibit a long-bodied composite bogie carriage. The first-class compartments, of which there are two, are upholstered in velvet; the ceiling is covered with a silk stuff called coteline; and the panels at the backs of the seats are covered with Lincrusta-Walton. Two of the second-class compartments are upholstered in bronze velvet, and the third in English grey velvet; the ceilings are covered with American cloth, and the passage is decorated with green rep. The seats of the first-class compartments are movable, and form couches when required; both classes are supplied with lavatories, and are warmed with steam from the locomotive passing through pipes and cylinders under the seats. The lighting is by gas, and the brake in use is the Westinghouse. The weight of this carriage is 21 tons 12¼ cwt., and the dead load carried per passenger is 2,014 lbs.

L'Usine Raghuso exhibits two carriages: one a six-wheeled composite carriage, fitted with the Westinghouse brake, and containing two first-class compartments and a *coupé* to seat twenty passengers, and three second-class compartments with thirty places; the other carriage is of the first-class, in two compartments. The length of the first-named carriage is 35 ft. 10 in., its weight is 14 tons 18½ cwt., and the dead load per passenger is 669 lbs.

The carriages exhibited by the Boni Guelma mètre gauge railway are somewhat peculiar in construction, there being a corridor along one side of the carriage for half the length, and on the other side for the rest of the distance; but this corridor is uncovered, and only protected by a rail, so that the carriage has a somewhat three-cornered appearance. The carriage is divided into one first-class compartment with six seats; one first-class *coupé* with three seats; and four second-class compartments, with forty seats—forty-nine in all. A lavatory is provided, and the break used is the Smith & Hardy vacuum. The length of the carriage over frames is 42 ft. ½ in., and its weight is 13 tons 19 cwt. The dead load per passenger carried is 636 lbs. The other carriage exhibited by the same company is also a composite bogie carriage, divided into two first-class compartments, with twelve seats, one first-class saloon with twelve seats; and one second-class compartment with eight seats,—thirty-two in all; a lavatory is also provided. This carriage has a central corridor and end platforms; its length, over buffers, is 36 ft. 5 in., and its weight 8 tons 9 cwt.; the dead load carried per passenger is 591 lbs. The first-named carriage was made by the Société Dyle et Bacalan at Bordeaux, the second by the Compagnie Française de Matériel de Chemin de Fer at Ivry.

The mètre-gauge carriage exhibited by the Chemin de Fer du Sud is a composite bogie end platform carriage, seated for forty-six passengers, — fifteen first and thirty-one second class. The first-class is divided into two compartments, one for smokers and the other for non-smokers. Teak, in boards, is used both inside and out, and the ceilings are painted a light colour. The brake used is the Eames-Soulerin, combined with the pressure apparatus devised by M. Stilmaut. The length of this carriage is 37 ft. ⅞ in., its weight is 9 tons 5 cwts., and the dead-load per passenger carried is 451 lb. In a similar carriage of the second class, to seat fifty-six passengers, the dead load per passenger is 352 lb. The carriage exhibited was built at the works of the Société de la Bievre at Lyons.

The upholstery and finish of the English carriages is about equal to that of the Continental ones, and the iron work is superior to theirs. It is remarkable that no Continental carriage exhibited is fitted with six-wheel bogies; this, we think, is a mistake, especially when the great length of their carriages, 76 ft. 3½ in. over frames, is considered, as at high speeds the four-wheeled bogie does not ride nearly so easily as that fitted with six wheels does.

It may be interesting to compare the lengths of the different types of carriage per passenger carried, and also the dead weight hauled per passenger, it being understood that the full complement is taken in each case, and that the figures are arranged in order of length per passenger, beginning with the longest:—

	Length per passenger.		Dead load per passenger.
Lits-salon, first-class, side entrance carriage, P.L. and M. Railway	46·94 in.	...	4,316 lbs.
Sleeping carriage, first-class, with corridor, attendant, and heating apparatus, L. and N.W. Railway	42·00 in.	...	4,107 lbs.
Sleeping carriage, first-class, side entrance, Northern Railway of France	28·20 in.	...	2,640 lbs.
Composite, side-entrance carriage, Société Anonyme des Ateliers de Construction de Malines	—	...	2,014 lbs.
Side corridor, first-class carriage, P.L. and M. Railway	19·07 in.	...	1,741 lbs.
Centre corridor, first-class carriage, P.L. and M. Railway	18·74 in.	...	1,727 lbs.
Side corridor, first-class bogie carriage, P. and O. Railway	18·20 in.	...	1,727 lbs.
Fauteuils-lits, first-class, side-entrance carriage, P.L. and M. Railway	17·75 in.	...	1,611 lbs.
Side-entrance, composite carriage, Midland Railway	15·28 in.	...	1,282 lbs.
First-class, side-entrance, carriage, Northern Railway of France	14·10 in.	...	770 lbs.
Central corridor, mètre gauge, composite carriage, Boni Guelma Railway	13·65 in.	...	591 lbs.
Side entrance, first-class carriage, P.L. and M. Railway	12·46 in.	...	980 lbs.
Second-class, mètre gauge carriage, Société Anonyme Internationale	11·94 in.	...	—
First-class, side entrance carriage, Société Anonyme Internationale*	11·54 in.	...	—
Side corridor, mètre gauge, composite carriage, Boni Guelma Railway	10·29 in.	...	636 lbs.
Composite mètre gauge carriage, Southern Railway of France	9·65 in.	...	451 lbs.
Side entrance composite carriage, Usine Raghuso	8·60 in.	...	669 lbs.
Second-class, mètre gauge carriage, Southern Railway of France	—	...	352 lbs.
Side entrance, third-class carriage, P.L. and M. Railway	7·08 in.	...	477 lbs.
Side entrance, third-class carriage, Société Anonyme Internationale	6·26 in.	...	—

These figures are, we think, instructive, and tend to show what sacrifices the railway companies are making for the accommodation of the travelling public (at what cost to the said public who travel on Continental railways we are unable to say), and may afford some information to our readers as to the why and wherefore of the tendency of railway companies to foster third-class traffic.

It will be seen that, in order to provide communication between compartments, the length of the carriage per passenger carried has to be increased from 12·5 in. to 18·75 in., or by exactly 50 per cent., and that the dead load hauled per passenger carried is increased from 980 lbs. to 1,730 lbs., or by 76 per cent.; that a first-class passenger travelling in a corridor carriage occupies 18·75 in. of train length, and requires 1,730 lbs. of dead weight to be hauled with him; in a side-entrance first-class carriage, without lavatories, he occupies 12·5 in. of length, and requires 980 lbs. of dead weight; in a Lits-Salon the same figures are 47 in. and 4,316 lbs. respectively; in an English sleeping-car they are 42 in. and 4,107 lbs., while the third-class passenger travelling in a side-entrance carriage without lavatories only occupies 7·08 in. of length and carries 477 lbs. of dead weight with him.

If we take 1d. per mile as the charge for carrying a third-class passenger in one of the Paris, Lyons, and Mediterranean carriages of that class, then, *pro ratâ*, the charge for carrying passengers in the other carriages instanced should be:—

	By length occupied.		By weight hauled.
Lits-salon, P.L. and M. Railway	6·60d.	.....	9·03d.
Sleeping-carriage, L. and N.W. Railway	8·37	.....	8·61
Sleeping-carriage, Northern Railway of France	3·98	.....	5·53
Composite, side-entrance carriage, Société Anonyme des Ateliers de Construction de Malines	—	.....	4·22
Side corridor, first-class carriage, P.L. and M. Railway	2·70	.....	3·65
Centre corridor, first-class carriage, P.L. and M. Railway	2·64	.....	3·62
Side corridor, first-class carriage, Paris and Orleans Railway	2·57	.....	3·62
Fauteuils-lits, P.L. and M. Railway	2·50	.....	3·32
Side entrance, composite carriage, Midland Railway	2·16	.....	2·69
Side entrance, first-class carriage, Northern Railway of France	1·99	.....	1·61
*Central corridor, mètre gauge, composite carriage, Boni Guelma Railway	1·93	.....	1·24
Side entrance, first-class carriage, P.L. and M. Railway	1·76	.....	2·06
* Second-class, mètre gauge carriage, Société Anonyme Internationale	1·68	.....	—
First-class, side entrance carriage, Société Anonyme Internationale	1·63	.....	—
* Side corridor, mètre gauge, composite carriage, Boni Guelma Railway	1·45	.....	1·13
Composite, mètre gauge carriage, Southern Railway	1·36	.....	0·95
Side entrance, composite carriage, Usine Raghuso	1·21	.....	1·40
* Second-class, mètre gauge carriage, Southern Railway	—	.....	0·74
Side entrance, third-class carriage, P.L. and M. Railway	1·00	.....	1·00
Side entrance, third-class carriage, Société Anonyme Internationale	0·88	.....	—

* These are mètre-gauge carriages intended to be run at comparatively low speeds, and are lighter than main line carriages; the length occupied is, however, large in comparison with the weight hauled.

From these figures we see that the introduction of the corridor carriage and the lavatory is very expensive, the extra charge by length being as 1·76d. is to 2·65d., and by weight as 2·06d. is to 3·65d., while the Lits-Salon costs from 6·60 to 9d. in the same ratio. It must further be remembered that third-class carriages fill better than those of the higher class, and that the latter carriages are more costly to construct, in terms of the passenger unit, than those of the third class, and it thus becomes obvious that the figures given above do not fairly represent the difference in cost of carrying a first or a third class passenger, and that the ratio should be increased by some unknown quantity.

THE FORTH AND CLYDE SHIP CANAL.

THIS project, from time to time critically examined in the columns of the *Builder* (see September 6, 1884, and March 9, 1889), is now announced as having taken definite shape, preparatory to approaching Parliament for the necessary sanction. The Bill, it is expected, will be introduced next session. During the six months which have elapsed since our last reference to this most important scheme, there has been no more than mere desultory allusion made to it in public, but all the while the design has been steadily maturing in the hands of a private syndicate of promoters, chiefly belonging to Glasgow and Edinburgh, although partly drawn from more distant quarters. Messrs. D. & T. Stevenson, Edinburgh, are named as the engineers to whom have been entrusted the preliminary preparations, consisting of route surveys, plans, and estimates of cost. Nothing is as yet in completed form, but there can be no question as to the genuineness of the attempt about to be made, whatever may prove to be the reception accorded to the Bill when presented before the Legislature. It is believed that the route chosen will be that which the circumstances of this remarkable crossing of the Scottish Midlands naturally invites, namely, along the central depression extending from the Clyde in the neighbourhood of Glasgow to the Forth at or near the Port of Grangemouth. This is also, as it so happens, and as has already been pointed out in former articles, the narrowest crossing of the isthmus, the distance from deep water to deep water barely exceeding twenty-five miles. One section of critics of the Forth and Clyde scheme has always taken it for granted that operations would consist simply in an enlargement of the Old Forth and Clyde Canal; but this view of the matter was from the beginning untenable, not to say absurd, and to the initiated it is not surprising to learn that the engineers do not expect to utilise the old work to any extent worth mentioning, although they will no doubt be obliged to become the unwilling purchasers of it, at an estimated value, in fairness to the Caledonian Railway Company, the present owners. The old canal, while holding generally to the central valley above mentioned, follows nothing like the shortest route; it winds about a good deal, suiting itself to the varying contours of the surface, and it seeks Clyde waters, not at Glasgow, but twelve miles below, where at the time of construction the nearest deep water was to be found. The conditions are entirely revolutionised now, and the existing work, in its extravagant length of fully thirty-five miles, in the insignificant dimensions of its channel, and in its numerous shifts of level (thirty-nine altogether from the Forth to the Clyde—twenty up and nineteen down), is an altogether obsolete contrivance of the ship-canal order, although taking quite the foremost rank on the year 1768, when first entered upon.

Various estimates as to the cost of a ship-canal of the highest class between the two Scottish estuaries have been hazarded, the range being from seven to ten millions for a work on the same principle as the Suez Canal, giving unimpeded passage to war vessels and to ocean merchantmen of the heaviest tonnage. Government has been looked to wistfully for the initiative in this gigantic and costly undertaking, but hopes have never been seriously entertained that any Ministry was likely to take it up, and the company of promoters at present is, therefore, a private and independent one, although there may be some expectation of partial Government aid in the future, if not in actual money, in facilities at least for getting it subscribed or otherwise raised. Last month's naval manœuvres around the coasts brought the importance of a shorter passage for war ships than that round by the Pentland Firth, or by the English Channel, once more into prominence, and a naval authority engaged in these evolutions has since been quoted as pronouncing emphatically on the high value, especially in the event of war, of a lockless canal between the Forth and the Clyde, capable of giving passage to ships of the navy. This authority, it is understood, has intimated to the promoters his intention of exerting the influence at his command towards the realisation of a scheme of so much national importance. During the past six months public views as to the traffic which a ship canal at this point would be likely to attract have undergone considerable change, and from the indulgence of undue pessimism there has been in some quarters a strong tendency towards the opposite extreme. In the matter of through-going tonnage particularly, some extravagant estimates have been entertained. But, after discounting these liberally, there remains the prospect of a really very considerable traffic of this sort, founded on east and west ocean route conditions and probabilities, already alluded to in a former article. With regard to Glasgow and what may be called the local, as distinguished from the through-going, traffic, the influence of a direct ship channel to the German Ocean, the east coast ports, and London, might readily, in its results, prove altogether beyond expectation. At present its facilities are not much greater than will be those of Manchester when her canal is finished, and they are of like kind; a Forth and Clyde Canal would immensely increase, if not double, these, and not only would the water distance to London be lessened by well on for one-half, and the Clyde port brought within a closer touch than either Manchester or Liverpool, but the old navigable bearings would be so overturned as to place Glasgow within shorter sailing distance of the Metropolis than even Bristol, Cardiff, or Swansea. Not only so, but vessels from Liverpool or Manchester bound for London, with cargo or in ballast, would find the round by the new Scotch canal and down the east coast no longer than the Land's End and English Channel route, if not a few miles shorter; and they might in certain contingencies of wind and weather prefer the former, even with canal dues to pay.

EGYPTIAN ANTIQUITIES AND BUILDING-TOOLS.

MR. FLINDERS PETRIE has again brought to London an interesting and important collection of Egyptian antiquities, the result of his recent excavations in a district between the Nile Valley and the Fayoum, about forty miles south of Cairo. The collection is arranged in two rather inadequate rooms in the building known as Oxford Mansion, where it is terribly crowded, and where the objects run some risk of damage from the large number of visitors, who, during part of the day at least, have hardly room to move about. The objects recovered date from several different periods, from the twelfth dynasty up to that of the Ptolemies; but by far the most important are from a town of the age of Usertesen II., of the twelfth dynasty, and from another town founded in the time of Thothmes III., and existing until that of Menepthah, or, according to Mr. Petrie's dates, from about 1450 B.C. to 1190 B.C.

The earlier town and some of the objects found there should have a very special interest for readers of the *Builder*, for the place appears to have been built and used as the dwelling-place,—and possibly at the same time as the prison,—of the workmen engaged in the erection of the pyramid of Usertesen and its temple, and to have been deserted on the completion of those buildings; and an important part of the objects found consists of a collection of mechanics' tools. The town was laid out in parallel streets, which butt up against the town wall and form blind alleys, and from a number of indications Mr. Petrie draws the conclusion that it was largely inhabited by foreigners, probably slaves or prisoners of war. Some of the tools which these men used about 4,500 years ago may now be seen in a perfect state in the smaller room in Oxford Mansion, and others are there in a more or less dilapidated condition, but quite recognisable. There are a number of little flint saws,—flakes of flint with neatly-notched edges, which were probably mounted in wood; also a complete saw made out of a bivalve shell: a hole is made in the shell so that the fingers can grasp the thick edge of it, which is bound with reeds, while the thin edge is notched to form the blade. There are, besides, flint knives and hatchets and flakes and scrapers of flint, the exact use of which is not stated. A bronze chisel is to be seen, and a pointed bronze pin in a wooden handle, which looks like a bradawl, but is called by the non-committal name of "a piercer." Then there is a set of tools of almost pure copper, which were found altogether in a basket, and look almost new; it consists of two axe-heads of different sizes, which have ears at the backs for binding them to the handles; two adze-heads so fashioned as to be easily bound to such wooden handles as the one which hangs on the wall a little nearer the door; a knife-blade, and a chisel. Near these are a set of moulds of burnt clay in which such tools were cast, and an unfinished casting for a knife-blade. On the wall there hang, besides the adze-handle, a hammer-handle, and a number of bow drills of wood, with swivel tops and holes at the bottom, in which flint points were probably fixed; also two wooden mallets, one of the Indian club shape often seen in the wall-paintings, and the other of the same shape as a modern mason's mallet. Another most interesting exhibit is a brick-mould,—also very much like a modern one, but a little larger, though not of the gigantic size attributed to it by the *Times*. Near this are some plasterers' floats,—again almost facsimilies of modern ones,—and some plummets, which only differ from those of to-day in being of stone or alabaster instead of metal. There are also measuring-rods, which are quoted as part of the evidence that the workmen were foreigners, for none of them have reference to the standard Egyptian cubit, and on a table are a number of wooden cramps of the double dovetail form, taken out of blocks of masonry, and wooden bolts of various sizes which were found in the ruins of doors, and some of which are grooved and cut in a manner which show they were part of something like a lock. Some reed baskets hanging in another part of the same room are almost exactly like those in which English mechanics carry their tools, and might quite readily be mistaken for them. Near the window of this room are laid out a number of objects from beneath the foundation stone of the temple of Usertesen, consisting of several sets of models of workmen's tools, models of what are supposed to be stones for grinding grain, and strings of carnelian beads, which it is suggested, for want of a better explanation, may have been current money.

Among the other exhibits in the room may be mentioned hoes, rakes, sickles, and other agricultural implements, nets, balls of twine, pieces of rope, &c., brushes, spindles, sandals, stone saucers for grinding colours, and a number of the more familiar kinds of objects, such as fragments of altars and tables of offerings, pottery, sculptured slabs, statuettes, combs, necklaces, beads

and scarabs, sewing-needles, and hair-pins. In the second room are exhibited a small number of tools of the period of the great Theban dynasties; they differ but little in form from those of the period some eleven centuries earlier, which have already been described, but flint has disappeared, and bronze has taken the place of copper. This room contains quite a large collection of pottery, funerary statuettes, mummy-cases and masks, Canopic jars, and other objects of great beauty and importance, but which wear a more or less familiar aspect after the exceptionally interesting collection belonging to the earlier period.

NOTES.

MR. WOOTTON ISAACSON has intimated in the daily papers that he proposes to introduce a Bill next Session making it obligatory that when a house in a town is to be let or sold there shall always be a certificate from a competent sanitary inspector that the premises are in a proper sanitary state. This proposal has naturally elicited the inquiry as to why such legislation should be confined to towns. A correspondent in the *Standard* plaintively inquires why a person who proposes to be a tenant in a country house should not be protected in the same manner. The same person also gave an account of his having taken a house in the country which was found, after two members of his family had been taken seriously ill, to be in quite an unhealthy state. This is cited as an instance of the necessity for such legislation in respect of country houses. Long ago we insisted in these columns on the necessity of some legislation making it either incumbent on all persons who kept lodging-houses to produce, if required, a certificate that the premises were in a proper sanitary state; or, at the least, that the Local Authorities at watering-places should issue certificates to keepers of such lodging-houses as had been inspected and approved by the Sanitary Authority. But there is an immense difference between lodging-houses and ordinary dwelling houses in town and country, and such legislation as Mr. Isaacson proposes is somewhat too grandmotherly in its nature. As a matter of fact, at the present time any person who proposed to become a tenant or purchaser of a house, whether in town or country, is in a position to protect himself as regards the sanitary condition; he can always have the house inspected by a competent person, and if it is not in a good sanitary condition, he can either decline to take it or make such terms as will allow him to put it into a proper state for himself. Further than that, a would-be tenant or purchaser can always ask whether the premises which he desires to take are in a proper sanitary state. If he receives a reply in the affirmative, and it proves to be untrue, he has an undoubted right to damages for misrepresentation. It is quite true that not a few actions of this character have been brought and have failed, but this has resulted from the fact that the lessor has not been proved to have made the representations relied on. There is, therefore, no practical need for the legislation which Mr. Isaacson contemplates; it would be legislation for the benefit of the careless and improvident, and not for the benefit of a provident and sensible man. The latter, as we have said, will always have premises inspected or obtain representation from their owner.

THE case of lodging-houses is entirely different. The owner of such a house lets it out often in rooms, often many times to different persons in the course of the year. Often, also, rooms are necessarily taken in a hurry, and it should be the duty of a person who offers rooms for occupation in this manner to be able to give evidence, by the aid of a certificate, that they are in a proper sanitary state. The opportunities for inspection and the time are much more limited in lodging-houses. The fee for inspection, which is trivial in the case of a house which is to be taken even for a short time, is proportionately large in the case of a room which is to be occupied for a few weeks. In fact, the more the question is looked at, the more necessary will certificates appear in the case of lodging-houses, and the more vitally do they appear to differ from ordinary dwelling-houses. We have spoken of lodging-houses alone; it goes without saying that every hotel-keeper should be bound to have his house inspected by a proper sanitary officer at least twice a year. A traveller may be poisoned by a night in a badly-drained house without the least possibility of preventing it. Nor should any licence for a new inn ever be granted until the licensing authority are satisfied that it is in a proper sanitary state. This rule should apply to the smallest and largest houses, for the passing haymaker resting for a night at a small country inn is just as much entitled to protection from illness as the wealthiest American who spends his dollars in a West-end palace. Legislation on the lines which we have indicated is practical and urgently required. That which Mr. Isaacson contemplates is the reverse. In any case, that which we have pointed out comes first, and we hope that some Members of Parliament, as the question of sanitary legislation is now before the public, will endeavour to carry a clear and common-sense measure which shall protect travellers at hotels and those who have to occupy lodging-houses, not only in the seaside and other health-resorts, but in the metropolis and other large towns.

BY direction of the Charity Commissioners for England and Wales, the Trustees of Dr. Daniel Williams's Charity have agreed to sell for 15,000*l.* the library buildings in Grafton-street, by University College, and an adjoining house, No. 18, which has served for a librarian's residence, having access, at the rear, to the library. This library was established, for a period of 2,000 years, under the will of Daniel Williams (who died in 1716) for the use of Nonconformist ministers. It was first housed in Redcross-street, Cripplegate, in a building provided by dissenters, and was there augmented by the Harris and Bates bequests. About 25 years ago encroachments for the Metropolitan Railway Company's extension towards Aldgate and the Tower involved the removal of the books to Queen-square, Bloomsbury, where they remained during some seven or eight years. Meanwhile had been erected the existing premises at a total cost of 11,000*l.*, including 4,000*l.* for the site, after the designs of Mr. T. Chatfeild Clarke, architect. The new buildings were opened in 1873. Dr. Williams appointed that his library should be free to persons of all denominations; and the twenty-three trustees have always been liberal in the matter of even lending such books as may not be in constant requisition. The founder also provided for the support of certain theological students at Glasgow University, the payment of poor Dissenting ministers, and various kindred benefactions. He was successor to Richard Baxter,—whose portrait was deposited in the library,—at Pinmakers' Hall, Old Broad-street, which meeting-place is also associated with Dr. Watts's memory. The library contains a large number of volumes containing Roundhead sermons and tracts, whilst among the curiosities preserved here were the mask of Cartouche, the notorious Frenchman, and the glass bowl said to have been used for the baptism of Queen Elizabeth.

IN his opening address as President of the British Association, Professor Flower dwelt on the importance of bearing in mind and providing for the two distinct objects for which museums should be arranged: that of general instruction and interest to the public at large, and that of study by those who have a more serious and more intellectual interest in the objects displayed. It is a pity that Professor Flower did not take the opportunity of criticising the false economy by which the special adaptation of the Natural History Museum for these two purposes, which had been duly arranged by its architect, was put a stop to. Mr. Waterhouse had arranged, behind the rows of glazed cases in which objects were to be exhibited to the public, private corridors for students only, from which, under proper inspection, the cases could be opened from the rear and specimens examined and compared, with only the slightest possible interference with their public exhibition. This arrangement, made with a full practical sense of what was required in such an institution, was not allowed to be carried out, we believe from no better motive than economy in building.

FROM the condensed report in the *Times* of Mr. D. G. Hoey's paper, read at the British Association meeting on Saturday last, on "Improved Dwellings for the Poor," it appears that the author proposes to bridge over the gulf between remunerative rates of rental and the possibilities (or impossibilities) of paying them, by accepting "what cubic space can be got," and practically extending it, as far as atmospheric conditions are concerned, by the use of a system of ventilation which will change the air so fast as to materially reduce the usually-accepted minimum of cubic space per individual. This is to be effected by means of a stove, which is not, however, described in the newspaper reports of the paper. Mr. Hoey takes the arrangement of space on board ships as a model:—

"The plans proceed on the principle of the state cabin on board ship. Given a bare room, 15 ft. by 11 ft. by 13 ft. high, the door 2 ft. 6 in. in middle of 11 ft. end, leaves 4 ft. 3 in. on each side, enclosed by a partition 6 ft. from the door, forming two bed-closets, or cabins, 6 ft. by 4 ft. 3 in. by 7 ft. high. The partition is carried up to the ceiling, enclosing another bedchamber, 11 ft. by 6 ft. by 6 ft. high. The cabins are each fitted with two berths, 6 ft. by 21 in., leaving floor-space 6 ft. by 2 ft. 6 in., furnished with lockers and seat and cupboard. The bedchamber above has a bed 6 ft. by 4 ft. and floor-space 6 ft. by 5 ft. and 4 ft. by 2 ft., with 11 ft. range of lockers and a large cupboard. The space left for the family-room is 11 ft. by 9 ft., and 13 ft. high. There are numerous other provisions for convenience and comfort, including a cheap, economical stove, that burns any slack to white powder, does the cooking, the warming, and, the ventilating all at once, and every other provision has been made, down to the minutest particular, for economising space and cost of erection and of working. The stove has been tested and proved capable of giving a renewal of the atmosphere every hour, twice the 300 cubic feet supposed to be sufficient for a whole night; so that, whilst, without such arrangements, the adequate space of the statute is a delusion and a snare, with them any space, legally adequate or not, may be kept at all times, and without intermission, in atmospheric purity and comfort."

We shall be glad to have further details from Mr. Hoey as to his plans; but we fear that it is quite chimerical to expect the very poor in this country to put up with or look after a system of ventilation intended to keep the air of their dwellings in a healthy condition. They will either utterly ignore it, or, if they understand sufficiently how to do so, they will stop it. If it could be arranged to work automatically and so that no one could interfere with it, that would be the only chance. But the problem of economic provision of habitations for the poorest classes in our large towns is, we fear, a kind of Danaid's sieve: there is no bottom to it. When there are more people in a certain space than can possibly make a decent living in it, the provision of sanitary dwellings at a remunerative rent is practically an impossibility. It is an alternative between pauperism and emigration: we mean by pauperism furnishing people with dwellings at unremunerative rents, which is pauperising in principle, though it is one of the milder forms of the evil. This may tide over the time until in a generation or two the influence of better education has put a check on improvident marriage. But it is only a tiding-over; and, unfortunately, the further it is carried the more demand there is likely to be for it.

IN the current number of *L'Architecture* is printed a memorial to the French Minister of Instruction from a number of

Diocesan Architects of France (the signatures to it include the well-known names of MM. Baudot, Vaudremer, Corroyer, and Boeswillwald, inspectors of "travaux diocesains") in favour of the establishment of more systematic instruction for architects in the Mediæval architecture of France, the dealing with which is the special work of Diocesan Architects, and demands special knowledge and training. The memorial apparently points to the establishment of a special branch of study of Mediæval architecture in connexion with the École des Beaux-Arts, in which it is complained that the study of Mediæval architecture is neglected. In the same number appears a long paper by M. Charles Garnier in opposition to this idea, maintaining that the duty of the École is to teach principles of architecture, not special styles; that if there is a special class for one style there should be one for every other style of any importance; that young students are only too disposed naturally to "vagabonder" in their studies, and that the training of the École as at present established gives the architect the intellectual power of understanding and dealing with any style of architecture to which circumstances may direct his special attention. M. Garnier says:—

"La logique réclame toujours ses droits, et, s'il est bon d'étudier l'architecture du douzième siècle, il semble qu'il doive être aussi utile d'étudier la sculpture et la peinture de cette époque. Les arts d'une même période ne sont-ils pas solidaires? et, si l'on refuse aux architectes actuels la compétence archéologique, il faut bien aussi la refuser à ceux qui, élevés dans les mêmes doctrines, pourraient devenir leurs collaborateurs. Il est bien vrai que Viollet-le-Duc a confié les principales figures de la cathédrale de Notre-Dame à Toussaint, deuxième prix de Rome et classique très convaincu. Il est bien vrai aussi que ces figures sont parfaitement en harmonie avec le style de la cathédrale; mais Viollet-le-Duc a peut-être eu seulement la main heureuse, et son choix ne doit pas détruire les principes de prudence et de garantie. Il faudrait donc fonder à l'Ecole des beaux-arts, sous peine d'être inconséquent, un enseignement de l'art de Cimabué et d'Orgagna, et un enseignement de celui de Nicolas de Pise. Mais naturellement il faudrait aussi faire un cours pour compléter ces époques: il y aurait un cours de costumes du temps de Constantin; un autre du temps de François Ier; puis on irait aussi logiquement à faire poser des modèles revêtus de robes à paniers, de culottes à ponts, ou coiffés de feutres empanachés. Oui, créez seulement à l'Ecole des beaux-arts un chaire architecturale de moyen âge, et vous verrez bientôt les jeunes peintres, ardents et quelque peu paradoxaux, réclamer, avec toute apparence de justice, la création d'un musée de la mode et l'établissement d'un magasin d'accessoires, et vous ne pourrez logiquement le leur refuser; car l'Etat, qui a fait restaurer la galerie des Cerfs et les peintures du Primatice à Fontainebleau, qui vient de faire remettre à neuf le plafond de Lemoine à Versailles, qui, de temps à autre, fait mettre des nez ou des orteils aux statues mutilées, et qui a laissé regratter celles de la Monnaie, devrait alors avoir pour les peintres et les sculpteurs, tout comme pour les architectes, une école d'artistes spéciaux ayant étudié le caractère particulier de toutes les toiles et de tous les marbres qui se détériorent."

As far as concerns the general instruction given in the National School of Art, it appears to us that M. Garnier's logic is difficult to answer. Perhaps the question might be met by attaching to the appointment of Diocesan Architect a condition that the candidate should offer some proof, by drawings or writing, of his special knowledge of the Mediæval style.

MR. HENNIKER HEATON has given notice that next Session he will call attention to certain facts concerning the department of the Postmaster-General. Some of these have been pressed upon the attention of the Government before, but the present indictment,—as it might almost be termed,—consisting of no fewer than fifty clauses, contains some new and interesting information. The anomalies of Colonial postage is a favourite theme of Mr. Heaton's, and in this connexion he compares the cost of a *ton* of letters (1,792*l.*) and a ton of newspapers (37*l.*) to Australia. Another comparison is used which is certainly striking, but hardly fair. "It costs the public 5*d.* to send 200 letters to Australia, but a parcel of the same weight will go in the same steamer for 3s. 6d." There is no reference whatever to the cost of collection and distribution of the 200 letters, and such a comparison seems valueless. The following is more to the point, and is only one among several similar instances. "A letter posted in France for New Caledonia is only 2½d., whereas a letter to Australia (1,000 miles nearer England), by the same route, from the United Kingdom, is charged 5d." Letters from France and Germany to British India can also be sent for just one-half the charge from England. Attention is also drawn to the fact that single post-cards can be purchased for their face value in all civilized countries except England. Certain reflections are made upon the manner of publishing the accounts of the Department, and also upon its administration. It is stated, for instance, that at least 100,000 papers are confiscated every year, their senders not complying with the various regulations of the Post-office; and that, although the Telegraph Department is credited to the extent of 2,000*l.* a year for the sale of waste paper, nothing at all is credited to the General Post-office for this waste paper. In other countries such forfeited literature,—or part of it, at least,—is sent to the hospitals; but nothing of this kind is done in England, and as it is hardly likely that the papers are destroyed, they should be accounted for in some way. The concluding clause of the "indictment" justifies our use of this term. It is concise,—the shortest, indeed, of the fifty,—and runs thus:—"The permanent officials in the Post-office obstruct and object to every one of these reforms!" Mr. Henniker Heaton has experienced the fate of most reformers, but he is not easily discouraged, and possesses the essential qualification of perseverance in no ordinary degree.

THE paper by Mr. W. Santo Crimp, read at the Institution of Civil Engineers, and now issued as a pamphlet,* on the "Movement of Sewer-Air," gives an account of a series of experiments made by the author on a special length of sewer in the Wimbledon district, in order to ascertain the direction and extent of the movement of air in the sewer at different times of the year and under various temperatures and atmospheric conditions. The facts given lead almost inevitably to conclusions at variance with some theories about "sewer-gas" which have been for a good while accepted. The simple faith has been largely held and acted on, that sewer-air ascends habitually to the highest outlet of the system. Mr. Crimp's readings of anemometers placed in the sewer showed in the first place that currents of sewer-air were frequently too feeble to cause an anemometer to work (as we should have expected to be the case), so that in some cases only negative results were obtained; "but on the other hand," says Mr. Crimp, "the positive results were such as to show beyond doubt what is the principal agent causing movements of sewer-air"; and that agent, we are told, is the wind. We give the following extract from the paper, which is worth the careful attention of every one who is practically interested in the subject:—

"With regard to the question of temperature as causing movements of sewer-air, it has generally been supposed that the movements were principally due to that cause. If the assumption were a correct one, the sewer-air would pass upwards in winter, and downwards in summer,—that is, speaking generally. The movements would be most rapid when the difference between the temperature of the air and that of the sewer-air was greatest. Now, in the author's experiments, the greatest difference was found to be in October, when it averaged 8°·4, yet during that month the uphill currents were too feeble to affect the anemometer except upon three days. During the same month downhill currents were registered on twelve days.

In the exceedingly calm and foggy December, the difference was 7°·85, yet the results as regards uphill currents were altogether of a negative character, whilst downhill currents were registered on nine days. February, again, shows a difference of 7°·55, and whilst uphill currents were registered on nineteen days, downhill currents were found to prevail on every day; moreover, the movements were exceedingly active compared with those of the other months referred to.

The results obtained during February and March are in striking contrast, and it is obvious that the effects of temperature are weak compared with those of some other agent. The drag of the sewage, if of any appreciable degree, would have made itself apparent during the calms of December and in other months. The author would at once say that the experiments had not long been in operation before he found that the wind was practically the only agent capable of producing movements that could be registered by an anemometer. Numberless cases could be quoted from the mass of detail accumulated in making these experiments, but a few must suffice."

A number of examples are then given as to the direction and strength of the wind on certain days, and the registered movement of air in the sewers, at the same times, which we have not space to quote in detail, but the general result of which is thus summed up:—

"During the entire series of experiments the actual volume of air recorded as passing downhill exceeded that recorded as passing uphill by very nearly one-third, whilst downhill currents were recorded on 273 days as against uphill currents on ninety-seven days. The cases given could be multiplied if desirable, but throughout the whole series of experiments the same effects of the wind were observable; the direction of the sewer-air currents was determined by that of the wind, whilst the currents were either strong, or weak, or imperceptible, accordingly as the wind was fresh or light, or calms prevailed."

* Published by the Institution of Civil Engineers.

IN response to an invitation, we have visited the workshop of the "Guild and School of Handicraft," and have examined the objects produced there, some of which the Guild is sending to the coming Arts and Crafts Exhibition. The Guild, we are told, is an association of workmen which was founded some eighteen months ago, and is carried on upon the co-operative system, under the direction of Mr. C. R. Ashbee, who himself produces the designs for the whole of the work. The members of the Guild, who work in the shop during the day, are expected to teach in the school in the evening. The work done is of various kinds,—wood-carving, joinery, metal-work, plaster modelling, and decorative painting being most prominent; but the designs are all of a class which was exceedingly prominent at the exhibition in the New Gallery last year, which appears to be inspired by recollections of Blake, and is familiar to readers of a publication called "The Hobby Horse." We are far from thinking that the style is a bad one; but it is one that can appeal to but a small section of the public, and for which the demand is, and is likely to remain, strictly limited. If the Guild desires to avoid failure it will have to watch the drift of public taste with more than ordinary care, and be prepared to put the skill of its members at the service of other styles if necessary. Meanwhile, some of the objects we saw at the workshops,—notably some *gesso* panels and hammered copper dishes,—are admirable in design and execution, and promise well for the success of the institution.

THE *Times* of last Monday contains an interesting and reassuring account of the restorations and repairs which have been so long in progress at the Palace of the Doges in Venice, and which are now all but complete. Twenty years seems a very long period to devote to the repairs of a single building, but when that building is one of the great architectural monuments of the world, as celebrated for its beauty as for its unique character and design, care and skill in dealing with it are of such importance that, provided they are lavished without stint, no one will grumble at a little delay in completing the work. Whether the Ducal Palace of Venice is worthy of quite all the sentiment that has been so freely expended upon it or not, it is at least a monument in which all the civilised world takes a very deep interest, and which all the world will be glad to hear has been treated with such reverential care. The loss of the original capitals of the arcades is a subject for great lamentation, and it is possible that the extreme section of the impracc-

ticable anti-restorers will try to make their removal a crime; but it was evidently unavoidable, unless the building was to be permanently disfigured with heavy timber shoring until even that should be insufficient to keep it standing. Copies of the caps (provided they are as good copies as the time and trouble expended upon them would point to) are probably the best substitutes for the old ones that could have been found. Bad is the best, of course; no copy can ever be quite the same thing as an original, but they at least produce the nearest attainable effect to that aimed at by the designer of the building. The copying of the weather-stains is, of course, a piece of utter puerility.

ANYONE in search of the picturesque might do worse than pay a visit to the once busy and wealthy port, though now the sleepy and poor inland town, of Sandwich, in Kent. The narrow, crooked streets, bordered by overhanging and often dilapidated gables; the great market-place, where the grass grows between the paving-stones; the gateway opposite the little bridge over the river, once flanked by massive turrets, but now patched with weather-boarding; the bits of carved oak door-frames and angle-posts of the houses; but, above all, the spacious but now (at least in two cases of the three) ruinous churches, all tell a piteous tale of departed glory, but afford delightful material from which to fill the pages of one's sketch-book. The most interesting relic is, perhaps, the Church of St. Peter, which stands in the middle of the old town, with the south aisle roofless, all the monuments in ruins, and the greater part of the rest of the fabric only held together by frequent repairs and by rebuilding little bits as money can be collected for the purpose. Of the original structure nothing is left, but there are still fragments of Norman work and, indeed, of work of all subsequent periods. Some of the windows have been very fine ones, but except in the case of one, which is built up, very little of the old tracery remains. At the south-east corner of the church is a small building supposed to have been an "anchorage," with a vaulted crypt under it, originally reached by a newel staircase, now in ruins. The large Church of St. Clement has been very thoroughly restored, and is, consequently, less interesting than that of St. Mary, at the opposite end of the town, which bears all the traces of its very tragic history in its walls. To say nothing of burning by the Danes in almost prehistoric times, and other subsequent disasters, the tower of this building fell in the fifteenth century, and again in the seventeenth, and on the latter occasion destroyed nearly the whole of the church. The south arcade was never rebuilt; and one roof now covers the nave and south aisle, as well as the chancel and the adjoining chapel of St. Lawrence. The north arcade was rebuilt in wood, and the remains of the tower piers razed to the floor-level. The only bell is now hung in a wooden turret over the south porch. Some attempt has been made at restoration, but it appears to have consisted, partly at least, in cleaning the plaster off the walls at the east end of the church, revealing some very rough masonry, among the stones of which may be recognised various bits of moulding and ornaments from other parts of the church, that have been used up in the rebuilding,—probably after the last fall of the tower.

SANITARIANS who went to church last Sunday morning and listened to the well-known narrative, in the first lesson for the day, of the healing of Naaman the Syrian, might perhaps be tempted to suggest whether there were not a practical rather than a mystical meaning in the advice given by the prophet to the invalid, to "wash seven times." It is very possible that the leprosy of Naaman was mainly owing to habitual neglect of cleanliness, or at least that he would never have fallen a victim to it if he had been a man of sanitary habits. It is true that a special efficacy appears to have been attributed to the waters of Jordan in particular; but this might have been only to point the moral, that the thorough use of water, even that of a humbler river than Abana or Pharpar, was the great desideratum. There is a curious similarity between the temper in which Naaman received this homely advice, and the manner in which the religious folk of Scotland, a quarter of a century back, received Lord Palmerston's reply, when they sent to him to ask why he had not appointed a national fast-day on account of the cholera, and were told that the most important thing was to keep themselves and their dwellings clean and set their drainage right. Many thousands of our population, suffering from disease and discomfort arising from preventible dirt, might still find a practical application in the remonstrance made to the Syrian captain:—"My lord, if the Prophet had bid thee do some great thing, wouldest thou not have done it? How much more then when He saith unto thee, 'Wash, and be clean!'"

THE AMINES PROCESS OF SEWAGE TREATMENT AT WIMBLEDON.

A PUBLIC demonstration of the application of the "Amines" process of sewage treatment took place at the Wimbledon Sewage Farm on Wednesday last, when Herr Hugo Wollheim, the patentee, endeavoured to utilise the disinfecting properties of a mixture of trimethylamine and lime in the treatment of sewage.

Trimethylamine may be regarded as an ammonia in which the three atoms of hydrogen are replaced by three molecules of methyl, the formula being $N(CH_3)_3$. This compound, the use of which is so essential a feature of the so-called "Amines process," occurs ready formed in herring-pickle or brine, from which it can be separated by distillation with potash. The smell of this peculiar compound is that of herrings in a state of dubious freshness.

At Wimbledon the process adopted is of a very simple character. Lime is worked up in a mill with water to a thin milk, and herring-brine, obtained from Billingsgate, is added in the proportion of three grains to every seventy of lime,—the resulting seventy-three grains being the calculated amount required to disinfect and precipitate one gallon of average Wimbledon sewage, which is purely a dwelling-house product. We presume the quantity would have to be varied for sewage containing manufacturing refuse.

The mixture of lime and herring-brine is run into the crude sewage, which then passes into settling tanks, where in the course of half-an-hour the sewage settles, and a strongly alkaline effluent is produced, of clear yellowish appearance, rich in organic matter, and possessing an odour that has been variously described,—one enthusiastic believer in the process declaring that it has all the delightful freshness of the sea-breeze. When we say that to our sense of smell the odour was suggestive of that indefinable one that hangs about a fairly well-flushed urinal, it will be understood that in our opinion the sea-breeze has reason to complain of the simile.

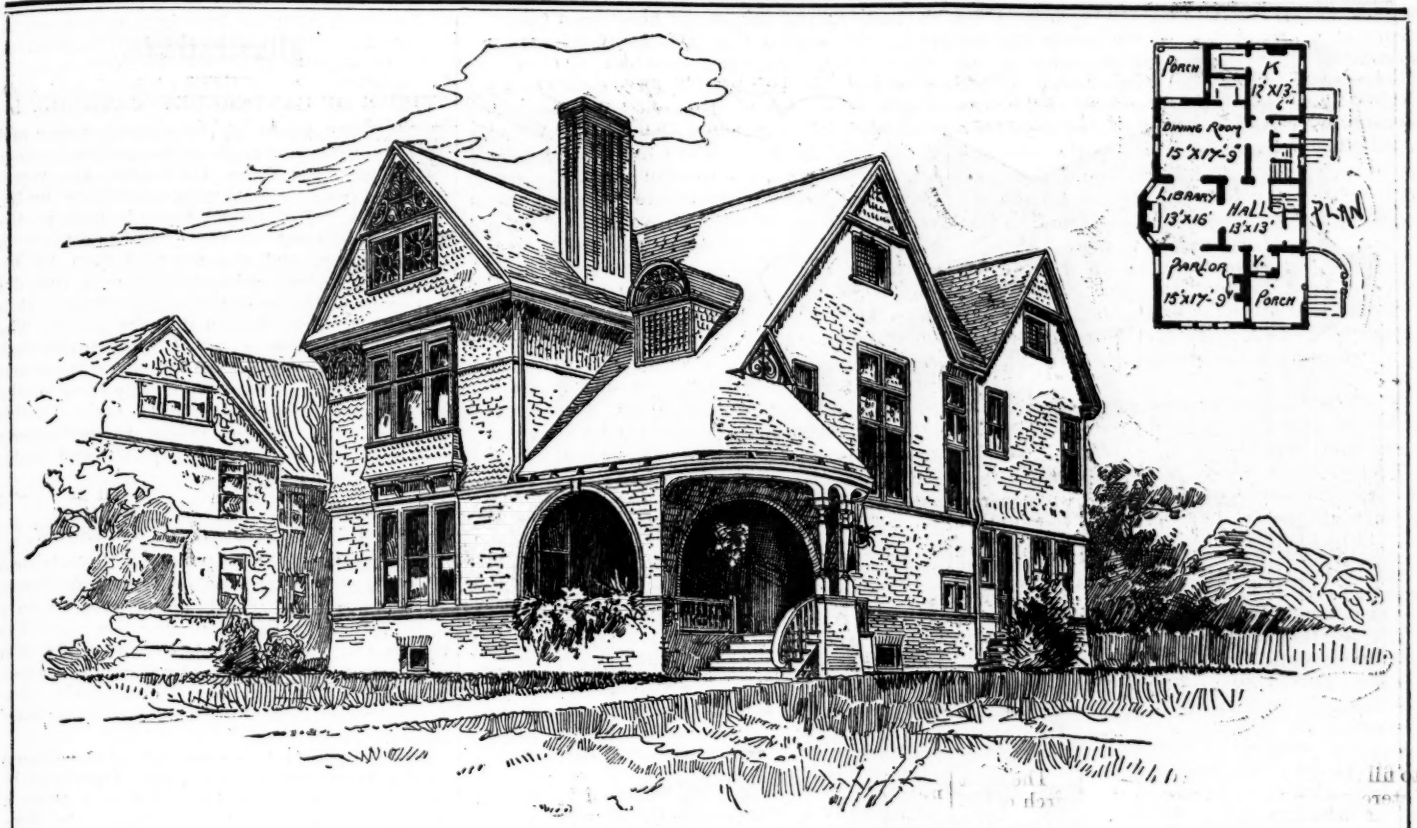
At Wimbledon the effluent is utilised for irrigation purposes, and the sludge is sold for one shilling per ton, which, considering the enormous proportion of lime that it contains, and its consequently strongly alkaline character, would seem to be quite as much as it is worth. The inventor states that the non-putrescent character of the sludge would make it peculiarly suitable for filling up low-lying lands without previous pressing or drying. If an extended experience sustains this claim, it will certainly be a point in favour of the "Amines" process; at present the only experience to guide to such an opinion is the naturally-imperfect, because limited, one gained by exposing a few tons of wet sludge for a few weeks at Wimbledon, when it was found that its bulk fell from 8 in. to 2 in., and a dry cake was produced, which was certainly free from offensive character.

A very serious point to be considered is the powerfully alkaline character of the effluent, due to the somewhat startling quantity of lime that it is found necessary to mix with the herring brine. At Wimbledon it is said that no bad effects upon the crops have followed its use, but the evidence here, again, is very imperfect, for we understand that the Amines process has only been worked intermittently and alongside of the Wimbledon Local Board's own process of lime treatment and irrigation. Until the Amines process has been in sole possession for some months it will be obviously impossible to say whether the effect will be deleterious or the reverse. But it is contended that the effluent is so free from offensiveness that it can be run into streams or water-courses without injury to the fish or the neighbourhood. No very valuable corroborative data was produced in support of this contention. It was certainly contended that dilution with river-water would prevent all evil results, but this is precisely the sort of argument that is urged by every one who wants to run something of doubtful quality into the neighbouring river. The disinfecting quality of the Amines compound still remaining in the effluent may be great; but, supposing a considerable town discharges all its effluent treated by the Amines process into a sluggish stream of moderate volume, the effect of the Amines compound would, before it reached the outfall, become exhausted, while the alkalinity of the effluent not being lessened very greatly by dilution would destroy fish life and increase the tendency to putrefactive fermentation. We make these remarks in no carping spirit, but simply because we consider that the process, as tried at Wimbledon, has yet to prove its value. It has some good points, but it is handicapped by several very doubtful ones, and, while wishing the Amines Syndicate every success in their endeavour to solve an important problem, we would strongly advise them to test the process for a very much longer time and under much more trying circumstances than obtained at Wimbledon, before taking the step, which we suppose they are naturally contemplating as the result of this public exhibition of their experiment, of inviting public support in the formation of a limited liability company.

A question which was very freely asked, and about which it was difficult to get any very definite information, was as to the extent of the herring-brine supply. Suppose several large towns adopted this process, and suppose, too, the herring fishery was a failure for a season, what could take the place of the brine? Visitors were told on Wednesday that brewers' grains, waste liquor from the beet-root industry, and other by-products, would serve the same purpose, but no experiments were quoted or authority given that such would be the case. Herring brine evidently possesses some special advantage, as it is used exclusively at Wimbledon; and as one large town might contract to take all the available brine, the working of the process would have to be confined to that town, the local authorities of which would ever watch with nervous anxiety the condition of the herring fishery.

A good deal is made of the sterility of the effluent, and considering that it is vouched for by so eminent an authority as Dr. Klein, F.R.S., the fact demands respectful consideration. But, after all, as it is not held that any actual destruction of organic matter takes place, but that the organic matter is merely for a certain time sterilised, it seems to us that the sterilisation is merely a postponement of the inevitable fermentation and oxidation of the dissolved organic matter. If beef-broth is boiled it is sterilised; if ordinary drinking-water is forced through unglazed porcelain, or air is filtered through cotton-wool, all germs can be removed; but expose the boiled broth, the water, or the air, in unsterilised vessels of ordinary cleanliness, and they will shortly abound in germs once more. There are germs and germs; the mere fact that the effluent at a given moment is free from them is of no particular importance unless it can also be clearly shown that the dissolved matter in the effluent is not of a character to nourish and develope those that it will inevitably receive from the air, and everything, in fact, that it comes in contact with. As the Amines process provides an effluent admittedly rich in organic matter, very unequivocal evidence should be produced that such an effluent will not, under varying conditions of temperature, air-exposure, and dilution, undergo putrefactive changes.

Reference is made, in a pamphlet on the process, to the prolonged effect of the dissolved disinfecting agent, whatever its exact nature may be; but, obviously, this must depend very largely upon the nature of the sewage and its degree of dilution. A few laboratory experiments at Somerset House, or anywhere else, will not settle this point; only the proof afforded by an extended experience derived from a large series of experiments on sewages of widely-differing kinds, would justify any local



House at Buffalo, N.Y.—Messrs. Silsbee & Marling, Architects.

authority in allowing such an effluent as is produced by the Amines process to pass into any reasonably clean watercourse. It is far better than crude sewage, undoubtedly, but more must be known of its behaviour under every possible condition of climate and dilution before it can be said without hesitation that it is free from danger and reasonably pure.

HOUSE AT BUFFALO, N.Y.

THIS view represents a house built from the designs of Messrs. Silsbee & Marling, architects, of Buffalo.

The exterior is shingled. The interior is finished with pine, except the stairs, which are in cherry wood.

ANCIENT FONTS IN COUNTRY CHURCHES.

THERE is a surprising number of fonts of Norman workmanship to be found in country churches in good preservation, notwithstanding their antiquity. These fonts, we must remember, are the work of masons who had to put out their fires at eight o'clock and remain in darkness till the dawn of day; and who had no surnames; and no means of going from place to place but on foot, or at most on horseback. They are large and massive and reflect, so far, the sombreness of the lives of those who made them. Their cumbersomeness made them not so easy to displace as some of those wrought in the succeeding centuries, such as we occasionally find disregarded in out-of-the-way places, in gardens, or perhaps in farm-yards, on account of having been supplanted by modern work. They were also richly carved, which may have been another reason why they were preserved through the successive reparations that may have taken place in the churches to which they belong. There was also in many cases some idea of sanctity attaching to a special font, which led to its preservation when the whole of the church was rebuilt. They are most frequently of a circular form, with four or more columns, sometimes surrounding the stem, though occasionally they are square. French antiquaries can point to another early form, in which the "cuve," or bowl, is made long and narrow, to permit an infant to be laid in it, as in the font in the Cathedral of Amiens. But in our own country these two forms were in general use till the octagonal and hexagonal treatment was adopted at a somewhat later period. In most instances these old fonts were raised upon one or two steps, though in some of the earliest examples the sturdy stem rises abruptly from the paved floor. When they were furnished with covers they were mere flat lids. It was not till the fifteenth and sixteenth centuries that these covers became such a special feature, and were elaborately carved and painted, and suspended over the fonts to which they belonged by chains from the roof.

In the neighbourhood of Aylesbury there are several Norman fonts. Northamptonshire, Lincolnshire, Cornwall, and Cumberland are also especially rich in examples. At Belton, in Lincolnshire, there is a specimen of late Norman work, on which the Norman mason rudely carved a rebus upon the name of the place, a man ringing two bells, suspended by ropes from a beam above him. In Rothbury church, among the hills and moors of Northumberland, where the Coquet winds in fantastic curves, there is a curious font. Though the bowl is dated 1664, the stem is covered with antique carvings representing animals, foliage, and the peculiar intertwining ropework identified as the work of Saxon masons. This was accounted for about thirty years ago, when in the progress of alterations, portions of a Saxon cross were found beneath the floor, which proved to be part of the same cross of which the stem of the font was made. Thus those who made the discovery were able to piece out the fact that in 1664 a font was made by using a fragment of an ancient Saxon cross for a stem and procuring a new bowl for it.

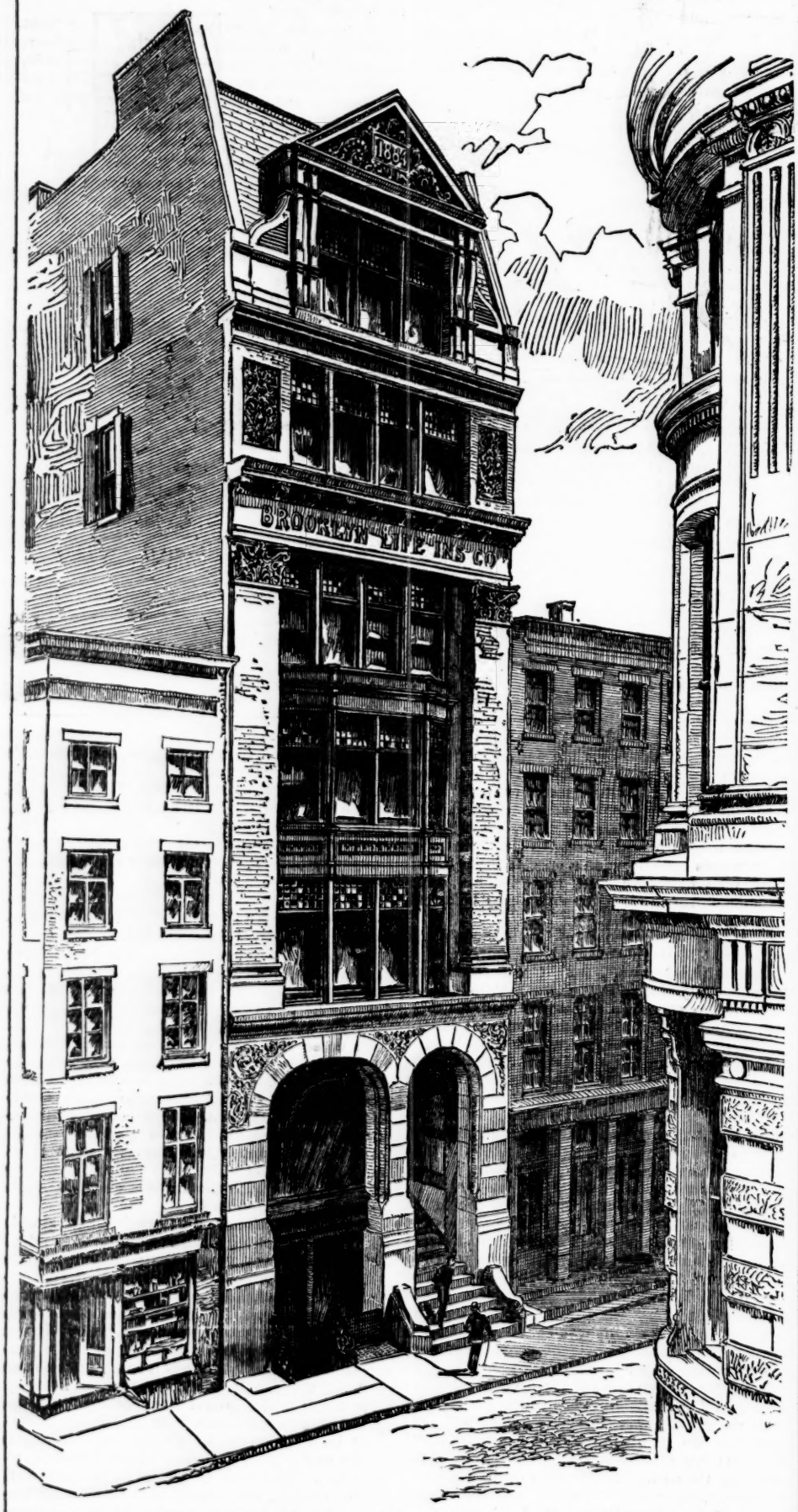
In the thirteenth and fourteenth centuries the octagonal form was frequently adopted. Like other details it was lighter than that previously in use. It also provided a larger number of panels for ornamentation and for heraldic purposes. On a small octagonal font in a church at Ingram, near the Cheviots, are the Percy arms and the date March 11, 1662, evidently a record of the fact that it was a gift from a Percy to the church. The Percy symbols may also be seen on a font at Alnham, dated 1664.

In the fifteenth century inscriptions were also added. There is one on the font in Threckingham Church, Lincolnshire, that has never been satisfactorily deciphered, abbreviations and obliterations producing a puzzle to which no indisputable key has been found in modern times. Eglingham Church, Northumberland, which is set in a bit of picturesque scenery, with a lakelet, a burn that comes down dashing over large rocks, and a cordon of hills, has a font with an inscription. Like the last-mentioned, this puzzles many readers. It says WASH ANDB ECLEN 1663 ϶+€ MASSON, which, being properly divided, is Wash and be clean, 1663. The monogram, doubtless, is that of the unorthographical mason. St. Mary's, Beverley, has a splendid font, 3 ft. 8 in. high, with a diameter of 3 ft. 10 in., which is inscribed round the rim, *Pray for the soules of Wyllem Feryfaxe draper and his wyvis whiche made this font of his pper costes the x day of Marche ye yere of our Lord* MCXXX. A Latin inscription is spread over seven sides of an octagonal font in Bourne Church. This reads, *Sup. omne nom I.H.S. est nom gde.*

In many churches the ancient bases have been retained beneath new fonts. In Widdrington Church, sacred to the memory of the doughty hero in Chevy Chase, who fought upon his stumps after the loss of his legs, there have been three fonts on the same circular raised base. The two that have been displaced are still remembered in the neighbourhood. Sometimes the font of one church has been transferred to another. A late vicar of Norham-upon-Tweed presented a new font to Ancroft Church, whereupon that formerly used there was passed on to Chillingham Church, where we may still see it with the initials of the Ancroft donor, R. M. W., upon it.

Here is Chillingham Church. It stands within bow-shot of Chillingham Castle and of Chillingham Park, where the wild white cattle still roam in undisputed possession of the original territory of their ancestors. The churchyard is green, and the little church is clad with ivy up to its tiny belfry for one bell. Within the porch is the ancient Norman entrance into the sacred edifice. There is a south aisle to the chancel, apparently made to receive a lordly altar tomb, which would have otherwise filled up the church too much. On this large monument lie two handsome effigies, representing a knight and a lady, with two angels kneeling at their feet. The font is placed at the west end of the church, and nearly in the centre of the nave. On it is incised, besides the initials mentioned above, "God bless this church. An. Domi. 1670."

Sometimes the condition of fonts, and sometimes their absence, is mentioned in the old visitation books. An entry relating to Alnwick, in 1608, for instance, mentions that several requisites are needed, among which is a covering for the font. The fine old church must have been stripped bare about this momentous time, for the same entry records that there was no seat for the minister, and that there were no cloths for the communion-table, neither were there any tablets setting forth the Ten Commandments and the degrees of affinity. We must infer, however, that the font was spared, as a cover was wanted for it, though the present one is modern. In the last century, when Alnwick



The Brooklyn Life Insurance Company's Offices, New York.—Mr. C. F. Merry, Architect.

Castle was embellished in the taste of the day, the church was also treated in the same fashion, and the old font may have been then removed.

The Brighton Borough Surveyorship.—Mr. G. R. Andrews, the Borough Surveyor of Brighton, has resigned that office, having obtained a much more lucrative appointment (1,200*l.* per annum). It is only six or seven months ago that Mr. Andrews was elected to succeed Mr. P. C. Lockwood at Brighton, he having for ten or eleven years previously held a similar appointment at Bournemouth.

THE BROOKLYN LIFE INSURANCE COMPANY'S OFFICES, NEW YORK.

THIS building had to be erected on a plot of ground of only 25 ft. 8 in. frontage, and the object was therefore to gain sufficient height to give the accommodation required, and the light, without sacrificing stability. The angles of the front are therefore strongly accentuated both structurally and architecturally.

The basement is of granite; the first story of Belleville brown stone; above this brick, with decorative details in terra-cotta. The architect was Mr. C. F. Merry, of New York.

Illustrations.

VIEWS OF CANTERBURY CATHEDRAL.

THESE views of the central tower and north-west angle of the eastern transept of Canterbury Cathedral are reproductions from delicate pencil sketches by Mr. H. Wilson. The central tower is, perhaps, the finest monument of the fifteenth century in this country, and was admired even by Mr. Fergusson, whose critical taste, as a rule, did but scant justice to Gothic architecture. It is but 233 ft. high, though it looks larger. The other sketch shows a part of the exquisite work of William of Sens, executed at the latter end of the twelfth century,—probably some of the earliest work in the Pointed style in this country. The foreign origin is particularly noticeable in the square capitals and plain, heavy roll-mouldings.

ST. PETERS' COLLEGE, GLASGOW.

THIS building, which is for the Ecclesiastical students of the (Roman Catholic) Arch-diocese of Glasgow, has just been commenced on a beautiful site at Bearsden, near Glasgow. The building will accommodate fifty students, each to have separate rooms, and will contain chapel, reception-rooms, library, lecture-halls, professors' rooms, refectory, kitchen, and servants' offices.

The College is being erected at the expense of the Most Rev. Charles Eyre, Archbishop of Glasgow, from the designs of Messrs. Pugin & Pugin, architects, of Westminster. Mr. John Devlin, of Glasgow, is the contractor, and Mr. Geggie the inspector of works.

Dumfries stone is being used for both dressings and facing, the former polished, and the latter rock-faced. The roof will be covered with green slates.

MUSEUM IN THE PUBLIC PARK, BARODA.

THIS elevation, showing an application of the Hindu style to a modern public building in India, was exhibited at the Royal Academy this year, and was commented on at some length in our remarks on the architectural drawings at the Royal Academy.* The architect is Mr. R. F. Chisholm, of Bombay.

CEILING, DRURY LANE THEATRE.

DRURY LANE Theatre has been undergoing a complete re-decoration during the recess, this part of the work being carried out by Mr. J. M. Boekbinder. The box-fronts have been re-gilt, but otherwise they remain as before, except that of the grand tier, upon the face of which cartouches enclosing shields bearing the names of famous composers and dramatists have been placed. The entrance-hall, the rotunda, the staircases, the *foyer* or saloon, and, indeed, the whole of the auditorium portion of the house, has been materially brightened up by the works now completed, which have been carried out in the short space of eight weeks. The stained glass in doors and fanlights of the principal entrance are by Messrs. Moore & Co.

We have been asked to publish the illustration of the treatment of the ceiling, which is given in this number, reproduced from the monochrome study of the design. The general tone of the ceiling is light, the prevailing colours being cream, buff, and grey, with red and blue sparingly introduced. The mouldings, which are not new, have been re-gilt. The "cameos" in the oval spaces consist of grisaille figures on a turquoise-blue ground. The new cove or frieze which runs round the ceiling has a Prussian-blue ground, on which are painted groups of musical instruments and shields bearing the names of celebrated actors who have walked the boards of "Old Drury." This cove or frieze covers over the trellis-like pattern which was until lately the sole decoration of this part of the ceiling.

The Junior Engineering Society.—Professor John Perry, D.Sc., F.R.S., has accepted the presidency of this Society for the ensuing (ninth) session, which he will inaugurate by the delivery of an address on "Mechanical Engineering in Electrical Industries."

See page 351, *ante*.

THE BRITISH ASSOCIATION AT NEWCASTLE-ON-TYNE.

THE British Association for the Advancement of Science has just concluded its annual week of congresses, lectures, exhibitions, and visits. From the reports which have been published in the daily press we cull two or three items that will be of interest to our readers, while one or two others are referred to under the head of "Notes."

Section G, Mechanical Science, was presided over by Mr. William Anderson, M.Inst.C.E., who, in his opening address, said he proposed to draw attention to a subject which appeared to be bearing with daily augmenting force on the practical manipulation of the materials used in construction. He alluded to the molecular structure of matter. This branch of science had, up to the present time, been left very much in the hands of the chemist and the physicist, and many engineers might think that it was by no means desirable to change the arrangement; but he was persuaded that the progress of engineering, the more exact methods of dealing with the properties of materials, the increased demands on their powers of endurance, rendered it imperatively necessary that mechanics should interest themselves more deeply in their internal structures and in the true meaning of the laws by which their properties were defined. After referring to the theories extant upon the subject, the President said that energy in the form of light operated changes in the surface of bodies, causing colours to fade, and giving to photography the marvellous power which it possessed; decomposing the carbonic acid of the atmosphere in the chlorophyl of green leaves, and determining chemical combinations, such as chlorine with hydrogen to form hydrochloric acid, or carbonic oxide with chlorine to form chlorocarbonic acid. It was inconceivable that these effects could be produced unless the undulations of light were competent to modify the molecular motions already existing in the solid, liquid, and gaseous bodies affected. Electricity exerted a similar influence. Generated by the molecular movements caused by chemical activity, whether directly, as in the primary battery, or in the dynamo, it was competent to increase the molecular movements in bodies so as to produce the effects of heat directly applied; it was capable of setting up motions of such intensity as to produce chemical changes and decompositions, to say nothing of the whole series of phenomena connected with magnetism, with induction, or the action through space and through non-conducting bodies, which, as in the case of radiant heat and light, seemed to imply the existence of an interatomic ether. Conversely, changes of molecular equilibrium, brought about by the action of external forces, produced corresponding changes in electrical currents; witness the effects of heat, for example, on conductivity and the wondrous revelations of molecular change obtained by the aid of Professor Hughes's induction balance. The behaviour of explosives illustrated also, and in a striking manner, the effects of disturbing molecular equilibrium. An explosive was a substance which contained in itself, in a solid or liquid form, all the elements necessary to produce a chemical change by which it was converted into the gaseous state. The application of heat, of pressure, or of impact, caused, as in Professor Spring's experiments, chemical union to take place, first at the spot where the equilibrium was disturbed by the application of external force, and afterwards, with greater rapidity, throughout the mass, the disturbance being propagated either by the air surrounding the particles or by the luminiferous ether, with all the rapidity of light; the chemical reaction was accelerated by the pressure which might arise, for example, if the explosive be confined in the chamber of a gun or in the bore-hole of a blast. It was a suggestive fact that the product of the atomic weight of certain groups of substances and their specific heats was a constant quantity which, for the greater number of the elements, did not differ much from 6·5. This implied that the quantity of heat necess ry to raise the temperature of the atoms of any one of the groups to any given extent was the same. Hence these atoms would be endowed with the same amount of energy at any given temperature, and therefore would be competent to replace each other without disturbing the general dynamic equilibrium. When it was conceded that molecular motion pervaded matter in all its forms, and that the solid passed, often insensibly, into the fluid, or even direct into the gaseous, it followed, almost of necessity, that there must be a borderland, the limits of which were determined by temperature and pressure, in which substances were constantly changing from one state to another. This was observable in fusion, but to a more marked degree in evaporation, where the particles were being incessantly launched into space as gas and return as constantly to the liquid state. If steel was looked upon as a solution of carbon and iron, then the hardening of steel was explained by the theory that dissociation had taken place at the temperature at which it was suddenly cooled, the sudden cooling fixing the molecular motion at such an amplitude or phase that it gave a characteristic structure, one of the properties of which was extreme hardness. In tempering, the gradual communication of heat caused dissociation again to take place, the molecular equilibrium was modified by the increased energy imparted to the particles, and when suddenly cooled at any point there remained again a distinct substance, composed of iron and carbon, partly in various degrees of solution and partly free, and again possessing special mechanical qualities. As far as he knew, no pure element was capable of being hardened or tempered, the reason being that no chemical change could take place when there was only one substance; the effect of heat or pressure, however suddenly applied, produced merely a change of form which did not appear to carry with it any corresponding alteration of mechanical properties. One of the most remarkable features of the last thirty years was the introduction of petroleum, and the wonderful development to which the trade in it had attained. Under the generic name of petroleum were embraced a vast variety of combinations of carbon and hydrogen, each of which was distinguished by some special property. At ordinary temperatures and pressures some were gaseous, some were liquid, and some solid, and most were capable of being modified by suitable treatment under various temperatures and pressures. The employment of petroleum in the arts was still extending rapidly. Used originally for illuminating purposes, it was now employed as fuel for heating furnaces and steam-boilers; as a working agent in heat-engines, valuable medicinal properties had been discovered; and as a lubricant it stood unrivalled. As an illuminant, even in this country, it was to a large extent superseding every other in private houses, and even in public lamps, because it gave a cheaper and more brilliant light than ordinary gas, and left the consumer free from the tyranny of great and privileged companies. As fuel it is especially convenient, cleanly, and economical. The President described the oil-bearing strata in Europe and America, and concluded by urging the want of a standard horse-power in marine engineering.

Sir William Thomson moved the vote of thanks to the President for his address, to which, he said, he had listened with thrilling interest. The necessities of the modern engineer led him to the very deepest questions of physics; and to those whose time and attention had been more devoted to the physical side of studies than to the practical it must be very pleasant indeed to find that the engineers were brought so thoroughly into harmony with the work of the physical engineer. The President had dwelt upon one of the most important subjects in physical and engineering practice—that was, the molecular construction of matter. The researches into force in modern artillery would contribute very largely indeed to the advancement of science. Might they not hope that the time would come when explosives in guns would be turned away from their present purpose, and that great guns would be used to demonstrate the effect of enormous pressures on the properties of matter in a purely scientific way? Concerning the durability of the petroleum supply, he had heard it said that petroleum was understood to be produced low down in the earth, and not taken from organic matter; but he could not hold that view with any certainty after he had heard Mendeleef's theory, so beautifully put before them by Mr. Anderson. They were very much indebted to their President for his address, especially upon a subject of such tremendous importance as the origin and possible durability of the petroleum supply.

Sir George B. Bruce seconded the motion, which was agreed to.

The President, in replying, said it had been stated in the newspapers that the petroleum supply of the Caucasus was becoming exhausted, and if this were true it would go far to upset his theory; but, by a strange coincidence, he had that morning received a letter from Professor Mendeleef, in which he desired him to say that it was absolutely untrue; that there was not the slightest falling off in the petroleum supply; and that the rumour which had got into the papers was a mere Stock Exchange scheme to make certain financial operations.

Mr. Killingworth Hedges, Mem. Inst. Civil Engineers, read the following paper on "Precautions to be Adopted where a Supply of Electricity is furnished by means of Transformers":—In a paper entitled the "Fire Risks of Electric Lighting," which was read at the meeting of the British Association held in Southport in 1883, I brought forward for the first time the necessity of electric light regulations and the use of safety appliances. The fire insurance companies have almost universally recognised that the electric light can only be considered a safe illuminant when the strictest attention is paid to the details of an installation; and the regulations which have been published by the principal companies and by the Institution of Electrical Engineers have so far proved successful, that no fire of magnitude can be traced to the electric light. The introduction of transformers has led to the increase of the electro-motive force in the primary mains, and there appears to be a tendency to decrease the pressure in the secondary, consequently there is an enormous difference of potential between the two systems, and a constant strain on the insulation of the transformer. A transformer may be compared to the reducing-valve which converts high-pressure steam into the safe pressure for working heating coils. There is, however, this difference,—a transformer never sticks like a valve, but it sometimes leaks, and the consequences are similar to those arising from a leaky reducing-valve. Supposing a small leak to take place between the primary and secondary coils; it is quite possible that a small current of dangerously high potential might be introduced into the secondary circuit, which would make very little difference to the light from the lamps, but might cause fatal results on any one inadvertently touching some unprotected portion of the wires or fittings with one hand and a gas-pipe with the other. To produce this effect it is necessary that some earth should occur on the primary main or mains. With the overhead wires which have almost universally been employed, with alternating currents of high E.M.F., any leakage to earth may be avoided; but with an underground system, and with the increased pressure which is about to be introduced, there is sure to be some earth connexion; in fact, with the Ferranti system, one of the conductors is to be earthed throughout. Allowing that a possible danger exists, the question is to find a safe preventive, and with this object it is proposed to briefly recapitulate what has been done. Mr. Kent inserts a metallic shield between the primary and secondary coils of the transformer; this sheet of metal is connected to earth. Now, if the insulation of the primary coil should fail, the leak before reaching the secondary coil must pass through the sheet of metal and thus to earth, causing the primary cut-out to melt, and thus cutting out the faulty transformer. The next plan is still simpler, and is to earth the secondary circuit, so that the effect of a contact in the transformer would be to establish connexion through the earth and to blow out the primary fuse as in the previous method. It has been stated by several high authorities that this arrangement is all that is wanted to secure perfect safety against shock; but the question of fire risks has also to be considered, and these would be greatly increased, also the insulation of the wires in houses would have to be of the most expensive character. Allowing that every care had been taken with the insulation, the proximity of gas and water pipes in a house to the wires, which are often laid under floors, might open a path for the deviation of a leakage current, say of 2,000 volts or over, and an arc once formed would result in a dangerous fire. The fire insurance offices have not sanctioned this plan, which does not even appear to be used in those go-ahead institutions, the electric light companies of the United States, who apparently

employ no safeguards, and trust to Providence with regard to the "burn-out" of a transformer, having a ready supply of duplicate parts to at once replace the faulty instrument. We now come to the intermittent earth device; that is, the automatic apparatus which only comes into play when the potential in the secondary has dangerously increased. Dr. Fleming has described an instrument which consists of a fine-wire safety catch holding down suitable contact pieces in mercury cups against the pressure of a spring. The safety-catch would be arranged to stand the normal difference of potential between the two secondary mains, but as soon as that rose beyond a certain amount the circuit would be automatically broken. This plan has the disadvantage of a certain amount of loss of current, which would be, however, checked by a resistance; but it avoids the necessity of using an earth. Dr. Bernstein advocates the contact-plug, which contains a substance, the resistance of which can be made enormous with the normal current, but the heating effect of an increasing current causes the mixture in the plug to be decomposed, and a metallic circuit established. I am unaware whether this has been tried in a circuit from a transformer or not, but am afraid it would not answer in practice. Major Cardew, whose improved apparatus I have the pleasure of showing you to-day, has, so far, produced the most successful device. It has been called the static mouse-trap, in that it goes off directly an unauthorised volt enters it. The arrangement which you see on the table takes the form of a box; in it there are two brass discs, separated one from the other by an insulating washer of ebonite. Between the two discs is placed a small strip of aluminium foil, which lies in ordinary on the lower disc, which is connected to earth. The other disc is in connexion with the secondary coil of the transformer, and should any leakage take place from the primary so as to raise the potential in the secondary say by 50 per cent., that part of the aluminium foil which is under a projection on the upper disc will be attracted to it, making an electrical connexion and starting an arc which short-circuits the secondary and causes the primary fuses of the transformer to be melted. Working quite distinctly from Major Cardew, I have also designed a safety appliance, which may be called a "vacuum cut-out." It is on the lines of those lightning protectors which are often used with telegraph cables, but the electrodes are fixed at each end, and cause the current on its way to earth, after leaping across the points, to energise an electro-magnet which releases a short-circuiting device connected with the primary poles of the transformer, There is one great advantage in my vacuum cut-out, in that it is not affected by dust or moisture, which might impede the static arrangement. In practice, I propose using old incandescent lamps, with their broken filaments sprung, as they often are, one-sixteenth apart. The perfect vacuum must, however, be destroyed, or only high potential will pass, and the current will preferably short-circuit across the terminals, instead of leaping across the broken filament. A lamp of this description would cost very little, and could be fixed in the same manner as the Cardew cut-out, without any relay. Numerous experiments were made to ascertain the distance which an alternating current would leap across points in tubes exhausted to a certain amount. The results differed considerably from the figures given by De la Rue in his experiments with continuous currents. In one experiment with glass cylinders having conductors hermetically sealed in opposite ends, and with a pressure of 5m/m., less than that equal to an ordinary vacuum, an alternating current of 1,000 volts invariably passed between the ends of the copper electrodes, which were ·3 in. apart. The arc, however, did not remain steadily at the ends, but would first run down one electrode to the point where it was connected to the platinum wire, which came through the glass, with the result of fusing it away. The arc would at the same time extend almost to the glass, although the opposite electrode was left intact. The reason for this phenomenon with an alternating current may be perhaps explained in the discussion. In conclusion, I think that all those who intend using high tension alternating currents, for the supply of electric light and power, should be obliged to fix a safety device on the secondary circuit, near the transformer, with the object of not only protecting their own property, but also to do away with the possibility of an unauthorised current being inadvertently led into a building so as to endanger the lives of the public.

Perhaps we may be able to find room for abstracts of one or two other papers next week.

COMPETITIONS.

Proposed New Free Library, Aberdeen.—Seven competitive designs for the New Free Library buildings were lodged by local architects, the accommodation required being as described in our issue of July 13 last, p. 30. One of the conditions of competition was to the following effect:—"The author of the design placed first in the order of merit by the Town Council, or assessor, will be employed as architect for the library, upon the usual terms of professional remuneration, and the author of the design placed second will receive a premium of 25 gs. If, when tenders are taken, it is found that the cost of the design placed first exceeds the sum of 7,500*l.* by more than 2½ per cent., the design will be set aside without any compensation or allowance, and the Town Council will fall back on the other designs according to the order of merit." The Town Council has now fixed on a leet of three in the following order of merit, viz.:—1. Design marked "Light B"; 2, "Light A"; 3, "Viaduct." The envelopes containing the names of competitors having been opened, these have been found to be respectively from (1) Mr. Alexander Brown, architect; (2) Messrs. Matthews & Mackenzie, architects; and (3) Mr. Pirie, of Messrs. Pirie & Clyne, architects: all of Aberdeen. The decision as to Nos. 1 and 2 having been unanimous, a reference to the professional arbiter was deemed unnecessary. Mr. Brown has adopted French Renaissance as the style of architecture, and the height of the front elevation from the level of the Viaduct to the parapet is 52 ft.

CONCRETE FLOORS.

SIR,—Mr. George L. Sutcliffe [see p. 178 *ante*] is entirely right in regarding as "the most important statement in the whole essay" that passage of my recent contribution wherein I remark "the strength of slabs is inverse to their breadth or diameter, and is as the square of their thickness."

You are aware, Sir, that, before Mr. Sutcliffe's letter appeared, it was my intention to contribute a further article dealing expressly with the theory of stress in slabs as distinguished from beams. So far as I am aware, this theory has never yet been published. Some years ago I was anxious to find some clear published statement of this theory. All I could find was Professor Unwin's two formulæ for the greatest stress of square and rectangular plates; the very same formulæ as Mr. Sutcliffe now quotes. A formula is the result of a theory; but it is not always sufficient in itself to explain the theory on which it rests. For some long time I continued to apply these formulæ (which Professor Unwin published for iron plates) to concrete slabs, as well as to iron plates, knowing that (to use Mr. Sutcliffe's expression) "the rule will hold as good for one material as for another." I applied the formulæ of Professor Unwin to floor slabs which I had constructed, and which I knew were more than safe; and, by means of this application, I settled a *constant*, of 2·3 lb. dead load per inch of slab surface-area, as the safe constant applicable to these formulæ. If Mr. Sutcliffe will refer to page 524 of the *Builder* of April 3, 1886, he will there find a letter, in which I gave the particulars on which I based this constant. I was in doubt at that time whether these formulæ were due to Unwin or to Grashof.

Subsequently, I arrived at the conclusion that Professor Unwin's formulæ are misleading, because inducing calculators to greatly underestimate the real strength of slabs and plates. Professor Unwin himself, in a footnote to these formulæ, makes the important admission that "some experiments by Mr. R. Wilson (*Engineering*, vol. xxiv., p. 239) appear to show that the ultimate resistance of flat plates is considerably greater than that obtained by putting f = the breaking stress in the above formulæ;" and he adds, by way of apology, "These formulæ are strictly applicable within the elastic limit only, and Mr. Wilson's plates may have been dangerously strained long before giving way. They did take a large set."

Therefore, having concluded them probably at fault, I ceased to rely on these formulæ, and thought out the stress question for myself on the following lines. I invite Mr. Sutcliffe to test my theory for himself; and if he can find any flaw in it, I shall be glad to have it corrected, both for my own sake and for the sake of others.

The resultant of any number of parallel forces is the sum of those forces acting through their common centre of pressure.

The supports which contribute to sustain any total load divide that load amongst themselves according to their number and position.

Thus, a total load equally distributed along any beam, supported at the two ends only, becomes subdivided into two equal loads, one of which bears on one support, and the other on the other.

Thus, likewise, a total load equally distributed over any slab of square shape, resting on four edges, becomes subdivided into four equal loads, one resting on each edge. If the slab be rectangular then the total load becomes subdivided into two pairs of loads, whose relative magnitudes are as the relative lengths of each pair of edges.

For example, a 100-ton total distributed load becomes, in the case of a beam, 50 tons on each end; in the case of a square slab, 25 tons on each edge; or, if the slab be rectangular (say 30 ft. by 20 ft.), the 100-tons load becomes one pair of 30-ton loads (on 30-ft. edges) and one pair of 20-ton loads (on 20 ft. edges). In fact, just as the total top surface-area of a square or rectangular slab is subdivided into four triangular or trapezoidal areas by diagonals, &c. (as per diagram), so the total distributed load is likewise apportioned. We may similarly regard the rectangular top surface-area of a beam as expressing the load, divided, by a line across middle, into a pair of loads.

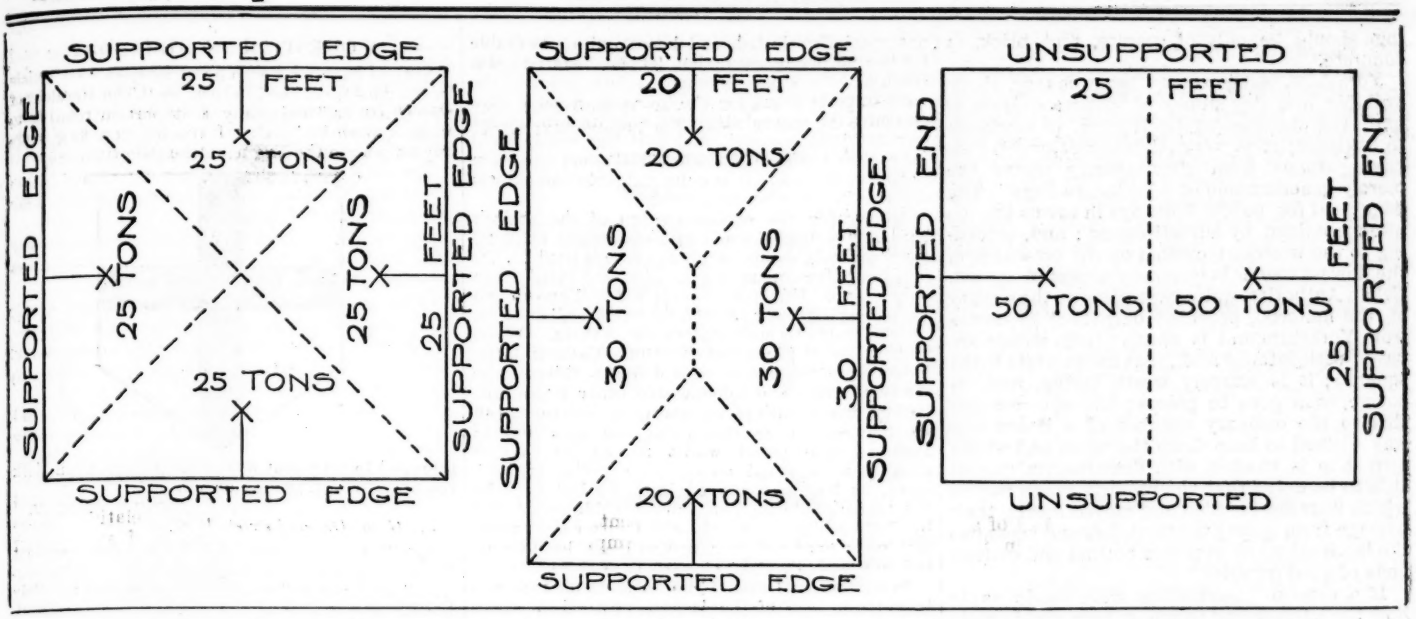
While the upper surface-area of a slab or beam, thus subdivided, shows the subdivisions of equally distributed total load, the geometric centre of each subdivision of area shows the true centre of vertical pressure of each section of total load, as indicated by the little crosses on annexed plans.

The resultant vertical downward force, acting through each cross on plans, is counterbalanced by the vertical upward pressures of the respective supporting edges of slabs, or ends of beam. And, just as the vertical downward pressures are equivalent to their sum acting through the crosses on plans; so the vertical upward pressures all along the edges of slabs, or ends of beam, result in each case in a central vertical upward force, equal to the sum of each set of vertical upward forces respectively.

The downward and upward resultants of each subdivision of total load perfectly counterbalance each other. But, as these two resultants do not act in the same vertical plane, they meet each other by means of horizontal forces acting through the slab or beam. Each edge of slab, or end of beam, is invested with a distinct set, so to speak, of these horizontal forces; and each set issues in a resultant horizontal force (equal to the sum of each respective set of horizontal forces) acting through the common centre of each respective set of horizontal forces, as indicated by the lines on the diagrams.

The horizontal force contributes leverage to the vertical force. That is to say, the horizontal force constitutes the "arm" of the "couple" of vertical forces; and, by means of the horizontal force, each subdivision of the slab or beam becomes a cantilever. The effective resultant length of the leverage is the horizontal distance between vertical downward and vertical upward resultants. With equally distributed load, the resultant leverage of a beam is equal to its quarter span—and of a square slab, is equal to its sixth span; because (as the crosses on plans show) the centres of vertical downward pressure occur at those distances respectively.

In the case of rectangular slabs, the mitre lines which subdivide the load into its two pairs, are not at an angle of 45° with slab edges, but are at an angle such as makes the two triangular areas bear to the two trapezoidal areas the same ratio as the length of the ends bears to the length of the sides of rectangle. The centre of trapezoidal area occurs farther from the supporting edge than the centre of a triangular area of equal perpendicular; and thus the leverage, as well as the load, of trapezoidal area is greater, making the stress of the trapezoidal portion of rectangular slab more or less greater than that of the triangular area of same slab, as the rectangle departs more or less from square. Thus, when rectan-



gular slabs are of length far exceeding breadth, they are virtually beams; and thus *the more nearly square the slabs, the stronger they are.*

To compare the stress-causing forces of slab and of beam, take, for example, a beam and a slab, each having an area of surface between supports of, say, 625 square feet. Let the span of beam be 25 ft., then it will be 25 ft. broad. We need not, in this comparison, specify *thickness*, as that shall be the same in both cases. The slab is, say, 25 ft. square between supports. The distributed total load shall be, say, 100 tons in both cases. Then the attacking stress-causing force on the beam will be $= \frac{100}{2}$ tons $\times \frac{25}{4}$ ft. $= 312\frac{1}{2}$ foot tons; and on the slab will be $= \frac{100}{4}$ tons $\times \frac{25}{6}$ ft. $= 104\frac{1}{6}$ foot-tons.

Thus we see that, under similar conditions, a square slab is three times as strong as a beam to carry an equally distributed load; because it subdivides the total load into smaller sections than the beam does, while at same time it shortens the arm of leverage to less than that of the beam.

Now, let the same load of 100 tons be, in both cases, concentrated on middle of beam and of square slab. Then the stress-causing force of beam is $= \frac{100 \text{ tons}}{2} \times \frac{25 \text{ ft.}}{2} = 625$ foot tons; and of square slab is $= \frac{100 \text{ tons}}{4} \times \frac{25 \text{ ft.}}{2} = 312\frac{1}{2}$ foot tons.

So, a square slab is twice as strong as a beam to carry a central load. And the effect of a central load on the square slab is three times as severe as that of the same load distributed.

We must, however, not forget that, in *practice*, with concrete floors, the weight of the slab itself is *always* a very large proportion of the total load; and this fact powerfully contributes to the practical superiority of the square slab over the beam.

The above mode of reasoning applies likewise to slabs circular or oval on plan; and also to slabs with holes or openings.

It was my intention to deal in this letter not only with the stress-causing *attacking* forces of slabs, but also with the stress-causing *resisting* forces of same. The measure of the latter is the measure of counter-leverage due to slab's thickness. I also wished to deal with the encastrement question. But I must leave these parts of the subject, at least for the present, as this letter has extended far beyond the limits I desired to observe. I trust I have said enough to satisfy Mr. Sutcliffe that I was not mistaken in stating that the strength of slabs *is inverse to their span*,—which was, as I understand him, the point he was in doubt about.

I ought not to leave this subject without saying a word as to the very greatly strengthening effect of a *rim* to each slab. In my own later practice I have adopted the expedient of casting the cornice-cove solid with the slab, and making the edges of the slab, where resting on walls, thicker by the depth of the cornice than the central or main portion of the slab. By this means I can safely employ much larger and thinner slabs than I could prudently use without rims.

If we would have a slab of equal strength throughout its entire area, we must give its soffit slightly domical curvature. But, though years ago I did many slabs that way, I eventually found it more convenient, less expensive, and otherwise preferable, in practice, to form the soffit of slabs *level* for ceilings of ordinary dimensions, giving more than equal strength to the centre, and employing rims as above stated.

The fact is, the curve of equal strength is so flat across the major portion of a span, and becomes quick and steep so close up to the bearings, that it really is not worth while, in ordinary-sized squares, to take any notice of the curvature, except by forming rims.

The rim of a tea-tray serves admirably to show what a rim can do for a flat thin slab.

FRANK CAWS.

SIR,—The rejoinder of Mr. Caws in yours of the 7th inst. to mine in the previous issue is quite a *non-sequitur*. The fault, however, is all my own. I took too much for granted, and left off with too little said; but I did not "miss the point."

Mr. Caws writes with too much perspicuity to leave any one in doubt as to *his* points. It shall be my aim now, in emulation of so good a model, to make my points equally sharp and equally incisive.

The original articles of Mr. Frank Caws on "Concrete Flooring" arrested my attention,—his ideal concrete beam-floor particularly, because *beam*-strength in *concrete pure and simple* is, to my mind, as much of a chimera as "perpetual motion." But now, and right here, let me explain. What I mean by beam-strength, in the connexion I employ this term, is an equipoise of compressile and tensile forces in a structure or construction, with the tensile as a factor of safety decidedly *in excess*,—a condition that no prudent constructor will overlook, especially where human life is concerned. Until this factor of safety was made possible in cast-iron by the labours of Hodgkinson in 1827–30, architects and engineers stood as much in dread of cast-iron as an engineering and building material as they now do (and rightly, too, in my judgment) of concrete.

The ideal concrete beam-construction which Mr. Caws in his first articles so ingeniously pictured is an impossible construction with concrete, *as he insists on using it*. Concrete holds to-day the same relation to engineering and architectural constructions that cast-iron, its analogue, held prior to 1827-30; and so it must remain, and will remain, until some power, as yet to mortals unrevealed, shall succeed in packing away *below the neutral axis* of a concrete beam, six times (or the necessary equivalent) as much concrete as there is above it, and *in a space no larger* than that occupied by the compressional material.

In the light of this statement of my views on "concrete (*without*) iron as a building material," I may now say that my use of the term horizontal cleavage had reference, not to the "shelliness" of badly-mingled and badly-made concrete, but to that horizontal cleavage which arises where two determining forces are battling for the mastery in a structure or construction *under bending stress*, in which the dominant tensile power forces on the issue of *horizontal cleavage or absolute crush*:—a state of things that never takes place in any concrete slab or floor made in the manner set forth by Mr. Caws, and to which he appears to be committed.

In this view of the case, and in conclusion, I may be allowed, I think, to say that in my humble judgment, the "cracks" that "are invariably clean, square-edged fractures" in the contractor's "miles of street-pavement and railway platforms" do not "fill the bill."—I am, very respectfully, THADDEUS HYATT.

9, Farringdon-road.

P.S.—Forty years ago (when first struggling with problems in architecture, growing out of my Lights invention and its application as a new building material) I constructed for my own encouragement the motto, "Whatever *ought* to be done, *can* be done." Under this, I concede the possibility of a discovery, some day, of a compression-material (I don't think much ingenuity required to find it now) so weak in resistance to compression as to be the fit complement to Portland cement concrete in extension. But even then, the question of horizontal cleavage would still come up, and the tensile weakness of the work would still remain the measure of its *maximum* of strength, its capabilities, and its permanency.

SIR,—Mr. Caws, in his letter of last week [p. 194, *ante*], says that in mentioning half-a-crown a yard as the amount saved by omitting joists and one-coat ceiling, I leave out the cost of the remaining two coats of ceiling and of the flooring-boards themselves. Do I understand by this that Mr. Caws does not plaster his ceilings at all, or use any flooring-boards? I have not yet seen or heard of any concrete floors being left in this way, and I did not omit the two coats of plaster and the flooring-boards because I presumed they would be required. The tenants of the upper rooms of cottages and small houses like a plastered ceiling and boarded floor, and I think they would be very poor indeed if they occupied such houses as Mr. Caws describes.

My contention is that, in the ordinary way, a concrete floor would be finished with boarding, and that the ceiling would be plastered; therefore, the only saving would be in the joists, lathing, and one coat of plaster, *i.e.*, about 2s. 6d. per yard; and, as the concrete and centering (without any iron) could not be done under 4s. 6d., it must necessarily be more expensive.

I have not at any time said that my floor was as cheap as simple slabs of concrete, but that it was (within very little) as cheap as a concrete and iron joist floor, and that the advantages of the permanent over the removable centering fully made up for the slight difference in cost.

Mr. Caws, perhaps, does not know that a few months ago I was "a mere architect" myself, and only became a specialist when I was quite sure that my studies and experiments had resulted in something being evolved. MARK FAWCETT.

September 17, 1889.

ARTIFICIAL *VERSUS* NATURAL STONE.

SIR,—Sir Robert Rawlinson, in his letter in the *Builder*, page 194, rests upon a false premise.

He complains that Yorkshire flagged foot-pavements laid in London wear in flakes, alleging therefrom that artificial stone is preferable. All stones but granites and flints are laminated, but that is no reason why all build-

ings should be only of granite, flint, brick, or concrete.

Yorkshire, being a very large county, yields building and flag-stones of various degrees of hardness, closeness of lamination, or tendency to flakiness; it is very misleading to class all paving-stones from that county under the merely generic name of "Yorkshire flags." The flags used for public footways in towns are too often obtained by advertisement; and, according to the wretched custom of the present age, the lowest tender is generally accepted by the Urban Authority, quite regardless of the quality of the material, provided only that it comes from Yorkshire and is cheap; thus, streets are paved with inferior stuff, that flakes while being squared; it is scarcely worth laying, and, of course, soon goes to pieces; but what matters this to the ordinary member of a Board who was elected to keep down the rates, and whose own shop is stocked with Brummagem goods? It is to be noted that the unfairly rough way in which flags are handled and moved during their passage from quarry to street, jars and separates the laminations of even the bottom and densest beds of good quarries.

If a careful examination were made as to how the hardest and toughest beds could be obtained from the best Yorkshire flag quarries, and a sufficient price paid for squaring and laying on a properly prepared bed, fully jointed with cement or hydraulic lime, we should not be told that a mixture of granite chips and Portland cement would produce street pavement superior to and more homogeneous than Nature's alchemy has provided.

It is important that the jointing of flag pavement should be perfectly water-tight throughout, so that rain may not filter in or freeze, and flake the slabs at their edges: but this simple condition is seldom attended to.

For more than thirty years the town in which I reside was paved with the best quality *blue hard* Idle (Leeds) flags; those stones that were honestly squared "full to the square," with chisels only, and not mutilated by pitching tools, are without a flake now; but for the last ten years a bastard economy has reigned supreme, the lowest tender has been accepted, and the bulk of the recently-laid flags belong to the contractor's favourite group, bearing the quarry name of "*yellow soft*," many being self-faced, not worth tooling. Of course they have flaked: what else could be expected? Now, the Urban Authority is using a concrete pavement of granite chips and cement. One specimen of this material, laid down as an experiment some years ago, is not now in flakes, but in a series of knobs, unpleasant to walk upon, because cement, being softer, wears away from the harder granite; the rough, uneven surface retains mud in wet weather, and is nasty.

The foregoing explains Sir Robert's paradox.

TOWN SURVEYOR.

September 16, 1889.

SIR,—In your issue of the 14th inst., there is a letter upon "Artificial *versus* Natural Stone," which I think is so worded as to rather mislead the reader, and evidently quite unintentionally on the part of the writer.

Thus, after eulogising thoroughly well-made artificial stone in lieu of a natural flag-stone (which few doubt) he says:—"As a trial and test for wear betwixt natural Portland stone and artificial Portland cement stone, at a bank in London there are two doors. At one there was a natural stone, at the other an artificial stone, and this wore out three of the real stone."

The writer having previously stated the suitability of artificial stone for "indeed all forms for which stone is used," the reader may think the two test portions were the jambs, &c., to the doorways (not the doors, of course, as the writer says!), but I take it he wishes to point out the test portions were the steps to the two entrances, and that the artificial stone wore out three of the natural. This, of course, one cannot disprove, but from many years' experience, I claim that there are as many grades of artificial stone as there are of natural stone; that there have been many more failures of artificial than natural stone, particularly when compared with Portland stone, than which a better or an equal has not yet been found, and which, by the bye, is not a "flag" stone as explained by the writer, but a homogeneous mass of oolite. In the particular instance alluded to, stated as being a test case, the maker of the artificial stone was no doubt most assiduous in seeing that nothing but the most suitable material was used, and that the manufacture and laying was of the first order, whereas no such knowledge was imparted to the stone merchants, the stone being evidently taken haphazard, and whilst doubtless being in every way suitable for ordinary building purposes, excepting steps, was not specially selected, and hence quite unsuitable for the purpose named; but let the tests be again tried, and the stone merchants select and send the most suitable stone for the purpose, when I have no doubt the natural stone will hold its own against any artificial material, and that the same would have been the case if the artificial stone had been as badly selected as it is quite palpable the natural one was in the instance quoted.

As regards the earlier portion of the writer's letter, by which he would have us believe artificial stone for "all forms for which stone is used . . . . is beyond all compare the cheapest and best," I can only say that Portland stone is too well known and too old established to need any "puffing," or to be knocked aside by such statements as these. When such stone as is used at St. Paul's Cathedral, the Monument, the Home and Foreign Offices, the Horse Guards, and innumerable other important, besides the countless unimportant, buildings, can be pointed to as instancing the durability of Portland stone; and whilst it can be had as cheaply as artificial stone, terra-cotta, or Bath stone, as has been proved in many instances by the tenders published in your estimable paper, and by facts which frequently come under my notice, architects need not fear, and will not hesitate or fail to specify Portland stone as heretofore.

In conclusion, I should like to mention that not long since, one of the largest of artificial stone manufacturers was loud and continuous in his admiration of the Portland stone staircase in my office, stating that, in his opinion, there was nothing so nice.

F. J. BARNES,
Portland Stone Quarry-owner,
I. of Portland.

"THE PICTURESQUE OF COTTAGE ARCHITECTURE."

SIR,—I regret to find [see p. 166, *ante*] that offence has been given by the remark made in the Preface to my book on Old Cottages as to the limits of photo-lithography. It was certainly not intended to bear the meaning objected to, but was meant as an explanation that I found to be necessary to such of the general public and critics as might have wondered why this method was adopted instead of etching or one of the new processes.

Lithography is an excellent medium for architectural illustration, but there is a limit to the fineness of line of which it admits, and for artistic purposes it cannot, even in the best hands, compete with the delicacy and clearness of the small process blocks so often used in your own columns. This objection applies only to such very small drawings as mine, and I daresay might, as you suggest, have been evaded by an abler artist even if working under the limitations as to light and shade that I imposed on myself.

I am afraid I am but awkward in expressing myself, as I certainly intended the paragraph as an acknowledgment of my obligations to the *Builder*.

I hope I may be allowed to quote from my introduction, to show how cordially I agree with your remarks that some further quality than simplicity is necessary,—

"On the other hand, I do not wish to be taken as suggesting that any plain building will look well. On the contrary, well-thought out and planned proportion is, as in all architecture, of the greatest importance, and much is to be gained by the inclusion of some of the many features illustrated in my drawings, as long as the mistake is not made of crowding them all into one building."

RALPH NEVILL, F.S.A.

Sept. 10, 1889.

NORFOLK CIRCULAR TOWERS.

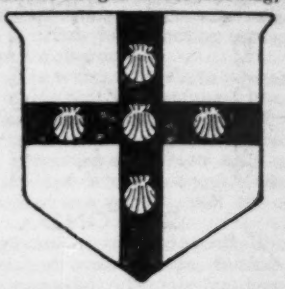
SIR,—As you have done me the honour to mention my name in the *Builder* of August 17, and have suggested in a "Note" on p. 119 that I am ignorant of the reason for many early church towers being built on a circular plan, I wish to say that I was perfectly aware that this was done to avoid stone quoins at the angles, owing to the scarcity of the material, and that I have repeatedly mentioned this in papers and addresses during forty years past. I was only briefly touching on pre-Norman remains in my address to the Section of Antiquities at the Norwich meeting, and did not go out of my way to mention such an elementary fact to my cultivated audience.

C. R. MANNING, F.S.A.

*** Mr. Mannirg's was the second reference made to the Norfolk round towers in the course of the congress, on both occasions without any reference to the practical reason for it. It is the small ones only that are built in this form, where the object evidently was to provide a small church with the minimum of cost.

A QUESTION IN HERALDRY.

SIR,—I have read with great interest your article in the *Builder* of the 7th inst. on "The Heraldry of the Crusades," especially that portion relating to "escallop shells." Can I trouble you to give me any help as to the origin of the following, which is



intended to represent five escallop shells upon black cross, and which are my own arms?

ARTHUR STONHAM.

57, *Great Ormond-street, W.C.*

*** The coat-of-arms sent by our correspondent is evidently of Eastern origin, and was doubtless conferred either on a Crusader or a pilgrim to the Holy Land. The colour of the shield is not mentioned, but we subjoin particulars of three examples from Papworth, of which the first may be the one, viz., a black cross on a *white* shield charged with five white escallops. There are many families bearing this device, the colours being differenced, with other details of minor importance.

1. *Argent*, on a cross *sable*, five escallops of the first. Borne by Stonham and Vastoyle.
2. *Argent*, on a cross *engrailed sable*, five escallops of the first. Borne by Bygod or Bygot.
3. *Argent*, on a cross *sable*, five escallops *or* (gold). Borne by Beauvais, also by Stonam and Vastoyle.

WEEDS ON CHALK ROADS.

SIR,—We are troubled with weeds growing on paths and roads of chalk bottoms, and composed of 8 in. chalk, 6 in. ballast, on loamy clay soil.

We are anxious to rid ourselves of this trouble, and should be glad if you will kindly insert this as a query in your next issue, as to the best means of doing so.

GEO. NEWMAN & CO.

HOUSES AT SNARESBROOK.

SIR,—In the plan attached to the view of these houses, published in your last issue, a slight omission has been pointed out to me by a reader, viz., that the door between kitchen and scullery is not shown. Of course there is one in the building, and obviously the omission is but a draughtsman's slip.

A. HEMMINGS.

Association of Municipal and Sanitary Engineers and Surveyors. — A Home Counties' District meeting of this Association is to be held at Wimbledon, on Saturday next, September 28. The meeting will be held at the Local Board Offices, which are close to the station. Mr. Santo Crimp will read a short paper on "Wimbledon and its Public Works." Subsequently, the members will walk to the sewage farm, and inspect the pumping station, the settling tanks, the sludge pressing plant, and the farm. A demonstration, by the Amines Syndicate, of the new Amines Process for treating Sewage (described and commented upon in another column of this week's *Builder*) will be given, and the process will, in the absence of Mr. Ellice-Clark, be described by Mr. Godfrey. The party will then proceed through the farm to the effluent outfall, which is near Earlsfield Station (London and South Western Railway). Members who have sufficient time at their disposal will visit the sewage farm and works at Merton, under the guidance of Mr. Chart, the Surveyor.

Opening of the Dewsbury Town Hall. —The new Town Hall at Dewsbury, which has cost between 40,000*l.* and 50,000*l.*, and which is described as being as complete a building as any in the North of England, was opened on Tuesday last by the Mayor of the town. The new Town Hall is in the Italian Renaissance style, and is surmounted by a tower 135 ft. high. With regard to the interior, there is accommodation provided for all the offices of the Corporation, the School Board, and the Chamber of Commerce, a room for Council meetings, borough court, and offices for the police and magistrates' clerk. There is also a central hall intended for public meetings, concerts, &c., which has sitting accommodation for 1,500 people. Messrs. Holtom & Fox are the architects. We are asked to say that all the doors are fitted with Kaye's patent locks and bolts.

The Student's Column.

WATER-SUPPLY.—XII.

FILTRATION.

FILTRATION is adopted to get rid of the suspended solids in water, both organic and inorganic, and in some measure also the impurities chemically dissolved in it. In cases where much suspended matter is present, as often happens when a river is the source of supply, the water to be purified is first admitted to settling ponds. The greater portion of the suspended matter is simply held up in water by the velocity of the current,—a fact abundantly testified by the accumulation of sediment in the bends and mouths of rivers. A river entering a large lake parts with nearly all its sediment,—a familiar example being furnished by the River Rhone, which runs into the Lake of Geneva laden with sediment, and issues from it quite clear, the muddy material having been deposited during its passage through the lake. In this way the lake is being gradually filled up. We cannot hope to so successfully imitate nature as to get rid of all the suspended matter, but by allowing river-water to rest in properly-constructed settling ponds, a great deal is accomplished towards this end. If we could only afford to permit the water to remain long enough, no doubt it would part with practically all this foreign material; as it is, however, such enormous quantities of water are required per day, that the process must, as a rule, naturally be carried on too rapidly to effect purification altogether in this way.

Settling-ponds are usually assisted by filters, made in various ways, whilst the filtering media are of different kinds. Filters, however, are considered by many eminent engineers to be unnecessary under certain circumstances. The late Mr. J. F. Bateman was of opinion that where water is taken from rivers, sometimes turbid, and always containing more or less foreign matters, and where it is taken from canals or reservoirs supplied by water flowing from gentle slopes of cultivated lands, it is necessary to filter it; and it is also occasionally requisite to filter water taken from shallow lakes. But in other cases he did not adopt filtration unless something special called for it. It is well known that in certain waterworks which were originally constructed with filter-beds, the latter have been done away with, because it was said that the quality of the water was not at all benefited thereby. In other words, it was found that by the system of decanting and drawing from the top of each reservoir, and straining through copper-wire gauze, the water was supplied as pure as if it had passed through the sand-filter. We are of opinion, however, that but very few sources available for large supplies exist in this country of sufficient purity to warrant us in saying that the improved systems of filtration would do the water no good; which opinion, we believe, is at the present time also shared by many water engineers. Unquestionably filtration has, in the majority of instances, a very salutary effect upon waters at present supplied to the public, but considerable difference of opinion exists as to what is the best practicable material to pass the water through to thoroughly effect its purification, if this latter be possible. Here, again, the "doctors disagree," so we may briefly describe the more prominent methods and substances adopted in filtering on a large scale, together with their comparative advantages. In doing so we must again divest ourselves of all bias, and, as far as possible, simply discuss the facts; but it may be profitable, firstly, to define the meaning of the word "fact," which in all discussions of this nature is necessarily of varying value. We take it that a fact in science appertains only to a thing well established, or which bears *primâ facie* evidence on its face. Theories and hypotheses only recently brought forward, and which have not been subjected to the searching test of time and scientific criticism, although often interesting to the specialist, ought not to find a place in a brief outline or review of the principal known facts or well-established principles concerning a subject, even although, from their familiarity to the reviewer, he may be sorely tempted to make allusion to them in his remarks. But let us now return to the immediate subject of the article.

Filter-beds have this in common, that the water to be filtered is passed through porous substances of sufficient fineness to prevent, as much as possible, the minute suspended particles in it from passing through. The material mostly used to effect this purpose is fine sand. The method of sand filtration on a large scale was first introduced into England in the year 1828, by the late Mr. James Simpson, who was engineer of the Chelsea Waterworks. A Royal Commission found that the water supplied to the metropolis from the Thames at that time was very objectionable, much suspended matter being clearly visible in it as it was delivered to the consumer, and Mr. Simpson, after numerous experiments, found that it could be cleansed by being made to pass slowly through sand held up by layers of grit and coarse gravel, the dirt being left behind on the surface of the sand. The accumulation of this dirty sediment was removed, at intervals, by scraping off a few inches of sand, thus exposing a new surface of clean sand to be next acted upon. The continual removal of the successive surfaces of the sand necessitated in time the re-making of the sand-bed by adding fresh layers of that material. This process is that adopted in all its essential particulars in the majority of our large waterworks at the present day.

In the case of a large supply, it is necessary to have at least four or five filters, because during the cleansing and replacement of the sand-bed, or through accident, it is requisite to empty a filter, and duplicates must at the same time be in working order to keep up a constant supply. They are often many acres in extent, for the purification, to be thorough, must admit of the water passing through the filters very slowly, and large areas are thus imperative when dealing with great volumes of water. The rate at which water passes through the filters depends on the grain of the sand, but principally, also, on the head of water. This rate is varied, at the will of the engineer, in different localities, depending on the class of water dealt with. In regard to the filtered water supplied to London, experience has shown that not more than 2½ gallons per hour should be allowed to pass through each square foot of area. Thus, each million gallons per diem requires about 16,700 square feet of filter at work.

In forming a filter-bed, care should be taken that the sand is not too fine, otherwise, as is often the case, the filter becomes speedily choked. Coarse, granular, and siliceous sand is the proper kind of material to be used. It extracts the particles of matter suspended in water quite as well as the finest sand, and is easy to clean, whilst fine sand is difficult to purify. After being thoroughly cleansed, the same sand may be used again and again for many years. At the same time, where it is readily procurable, fresh sand should be laid on as often as practicable. The section of an ordinary waterworks sand-filter, in descending order, exhibits sand of the above description, grit, small and then coarse gravel, large stones forming the foundation. It will thus be seen that the materials gradually get coarser from top to bottom, reasonable care being exercised to prevent mixture of the different strata. The thicknesses of the layers vary within narrow limits in different waterworks. The layer of washed sand forming the upper portion is often as much as 2 ft. 6 in. or more in thickness; whilst the total depth of the filter bed may be 6 ft. and upwards. After passing through this, the water runs off by means of drains to the pure-water tank or reservoir, and so into the mains.

The water may be passed either down, or up, or sideways through the filter. The first mentioned is the most common practice, the other two requiring some modification in the general arrangement of the filters. In the last mentioned method, the various kinds of filtering material are usually placed in compartments side by side.

From what has already been said, it will be apparent that sand filtration practically removes all suspended matter from water. In certain cases, however, it has not done this quite as efficiently as could be desired. For example, Mr. G. Higgin, M.Inst. C.E., referring* to some experiments he carried out with the water of the River Plate, describes it as containing a large amount of very finely-divided matter, which was incapable of being removed by ordinary filtration. He had, therefore, to adopt another method, which will presently be described.

The suspended matter arrested by sand-filters in the ordinary way, is formed of both organic and inorganic particles, so that a certain amount of organic contamination is thus got rid of. But the filtering action is something more than mechanical. Careful research has led to the belief that a part of the organic matter in solution is also removed; in other words, that the action is also chemical in its nature. It is highly probable that some kind of oxidising process is encouraged during the passage of the water through the sand, grit, and gravel of the filter. It is certain that by the expedient of intermitting the filtration, so as to allow of the aëration of the material composing the filter, this effect may be rendered much more active.* The amount of organic matter in solution thus removed is very variable, depending on the quality of water dealt with, the construction of the filter, and the method and rate of filtration.

Many rivers have gravel beds of more or less thickness on their flanks, in the bottom of their valleys, or flats, which gravel contains a great quantity of water, in some cases derived from the adjacent river, and in others, water *en route* to the river. It may also belong to the gravel deposit in its character of a water-bearer simply, in which case it would not reach the river. In any case it has undergone a certain amount of natural filtration, and is frequently intercepted and made use of both by water companies and private individuals.

* Min. Proc. Inst. C.E., vol. lvii. (1879), p. 272.

* See "Theory and Practice of Hydro-Mechanics," 1885, p. 30.

RECENT PATENTS.

ABSTRACTS OF SPECIFICATIONS.

12,258, Hinges for Folding Doors. T. Whittaker.

According to this invention, two semi-circular or U-shaped pieces of brass or iron are used; a slot is made on the circular part of each piece, and two halves of a cog-wheel are rivetted thereto. At each end is an iron or brass plate, which holds the two parts of the hinge in position, and bringing the circular parts together allows the cogs to gear, and the hinge to act both ways.

14,482, Wardrobe, Cupboard, and Door Fastenings. E. W. Taylor.

This invention relates to a fastening, automatic in its nature, which is obtained by an inclined plane in combination with the weight of the fastening itself. In the centre of a bevelled plate is made two parallel slots, which assume an angular position on the door-jamb when fixed, and when the door is shut it strikes on the bevelled surface, which, by reason of the inclined slots, is pushed anglewise upward and away, allowing the door to pass, when the plate again slides down, the slots securing it.

12,251, Flushing Cisterns. S. Grossmith.

The object of this invention is to ensure that the syphon in an automatic flushing-cistern goes off when a mere dribble of water is taking place, and also to ensure greater certainty of the automatic action. A casing chamber fitted with an annular cover and a filling tank, and connected by a lever to the top of the chamber, is so adjusted as to act by the compression of air within the chamber, turn the tank, and periodically flush the closet.

11,190, Sliding Window-Sashes. T. P. Descou.

The object of this invention is to provide means whereby window-sashes may be left open, to a certain extent, without the liability of their being opened from the outside. Stops or guards are used, which, after they have been moved to allow the sashes to be opened beyond the limit allowed by the stops, automatically resume their position and operation.

2,434. Mallets. H. Gribble.

A hollow cylinder is cast with taper openings, so that the shaft fits tight without the use of wedges. The hard wood head projects at each end of the cylinder, and forms a neat and efficient mallet.

NEW APPLICATIONS FOR PATENTS.

Sept. 2.—13,791, J. Davies and W. Lloyd-Davies, Ridge Capping and Tiles, &c. 13,807, W. Cussans, Fasteners, Bolts, and Hinges for Windows, &c.

Sept. 3.—13,847, J. & H. Wilson, Ornamenting and Decorating Ceilings and Walls.—13,851, W. Greaves, Chimney Top or Cowl.—13,872, P. Parsons, Moistening, Heating, and Ventilating Factories.—13,880, M. Griswold and W. Atterbury, Sheet or Window Glass.

Sept. 4.—13,915, T. Kershaw, Door Knobs and Furniture.—13,942, L. Böhm and K. Rumpf, Tip-Carts.—13,953, C. Crabtree, Drain-pipes.—13,961, A. Brooke, Hunt Door Knobs.

Sept. 5.—13,972, J. Hatton, Chimney-pots.—13,976, W. Farr, Wood-Block Flooring.—13,980, R. Macdonald, Syphon Cisterns for Flushing Water-closets.—13,984, E. Hoyle, Double-threaded Screw for Wood.—13,997, A. Spencer, Metal Floors, Buildings, &c.—14,004, B. Nienhaus and J. Gaetcke, Controlling Apparatus for Doors, &c.—14,009, H.

Jones, Chimney Cowl or Hood.—14,018, R. Brown, Portable Rain-water Pipes.

Sept. 6.—14,042, D. Law and others, Automatic Flushing Cisterns.

Sept. 7.—14,137, B. Malcolm and W. Pennington, Holding Sliding Windows in any required position. —14,145, P. Hoy and J. Jones, Drainage.—14,163, J. Kirk, Machine for Squaring, Bevelling, Mitreing, or Trimming Wood.

PROVISIONAL SPECIFICATIONS ACCEPTED.

4,107, S. Cochrane, Shutter, Door, and Window Protectors.—7,837, W. Byatt, Latches or Bolts.—8,551, A. Sutherland, Flushing Apparatus.—9,331, F. and J. Rowson, Syphon Flushing Cistern.—10,663, C. Winton, Preventing Sewer-gas escaping into houses, &c.—11,449, J. Moreton, Imitation of Inlaying.—11,843, W. Wise, Extension Ladders.—11,901, E. Truman, Sanitary Arrangements of Buildings, &c.—11,904, E. Cubbon, Water-closets.—12,053, F. Abbey, Fire-ranges or Grates.—12,126, J. and A. Duckett, Water-closets.—12,147, C. Darrah, Pedestal Water-closets.—12,306, R. Swales, Flushing Apparatus for Water-closets.—12,333, E. Kerry, Heating Greenhouses or other Buildings.—12,483, R. Thompson, Flushing Cisterns for Water-closets.—12,829, T. Metham, Joiner's Clamp.—12,836, W. Gordon, Water Cisterns or Tanks.—12,889, T. Smith and R. Wager-Tayler, Cement or Artificial Stone.—12,890, T. Smith and R. Wager-Tayler, Cement or Artificial Stone.—13,004, T. Routledge, Sash-fastener.—13,007, H. Beaumont, Bolts for Doors, Gates, &c.—13,008, J. Wilson, Fire-resisting Flooring, &c.—13,009, J. Wilson and others, Fire-resisting Partitions and Walls.—13,050, T. Hyatt, Pavements and Paving Materials.—13,203, J. MacMahon, Composition for Arresting Decay in Wood.—13,383, H. Perry, Cornices for Rooms.

COMPLETE SPECIFICATIONS ACCEPTED.

Open to Opposition for Two Months.

14,158, D. Clohesy, Under-cutting or Dovetailing Wood, Stone, &c.—14,963, E. Cox Walker and A. Swinton, Electric Bells and Signals.—15,136, E. Cain, Weather Strips of Doors for Excluding Draughts.—15,543, E. Newton, Horticultural Buildings.—16,131, A. McKechnie, Stone-dressing Tool.—16,323, A. Bouvier and J. Billoré, Bricks, Tiles, &c.—16,408, J. Sharples, Flushing Pans of Water-closets.—9,726, F. Bolus, Sewer Gas Preventive Pipe.—12,457, W. Bunting, jun., Water-closets.—12,501, J. Darby, Joints for Pipes.

RECENT SALES OF PROPERTY:

ESTATE EXCHANGE REPORT.

SEPT. 9.—BY DEBENHAM, TEWSON, & Co. (at Lowestoft).

Lowestoft—The Crown Meadows, containing 10a. 3r. 36p., f. £3,500

7 and 8, Crown-st., c., r. £31. 10s. p.a. 250

SEPT. 10.—BY WAGSTAFF & WARMAN.

Chelsea—22 and 23, Stanford-rd., u.t. 93 yrs., g.r. £8, r. £67. 12s. p.a. 390

Battersea—136, Battersea Bridge-rd., u.t. 48 yrs., g.r. £11, r. £42. 18s. p.a. 195

Mildmay Park—53, Queen Margaret's-grove, u.t. 69 yrs., g.r. £4. 15s., r. £41. 12s. p.a. 268

SEPT. 12.—BY NEWBON & HARDING.

Holloway—4, Tufnell Park-road, u.t. 33 yrs., g.r. £10. 10s., e.r. £60 p.a. 500

Islington—47, Orchard-st., u.t. 30 yrs., g.r. £2. 10s., r. £23. 8s. p.a. 160

29, Ecclesbourne-rd., u.t. 48 yrs., g.r. £5, r. £29 p.a. 270

Stoke Newington—111, Shakespeare-rd., u.t. 63 yrs., g.r. £6, r. £46. 16s. p.a. 205

Commercial-road East—F.g.r. of £18. 15s. p.a., reversion in 21 yrs. 305

BY GEO. NEWMAN.

Regent's Park—26, Elsworthy-rd., u.t. 75 yrs., g.r. £6, r. £100 p.a. 900

[*Contractions used in this list.*—F.g.r. for freehold ground-rent; l.g.r. for leasehold ground-rent; i.g.r. for improved ground-rent; g.r. for ground-rent; r. for rent; f. for freehold; c. for copyhold; l. for leasehold; e.r. for estimated rental; u.t. for unexpired term; p.a. for per annum; yrs. for years; st. for street; rd. for road; sq. for square; pl. for place; ter. for terrace; yd. for yard, &c.]

MEETINGS.

SATURDAY, SEPTEMBER 21.

Glasgow Architectural Association.—Visit to Ferguslie Park, Woodside House, and Coats' Memorial Church, Paisley.

TUESDAY, SEPTEMBER 24.

Glasgow Architectural Association.—Mr. David Barclay, Hon. President, on "Perspective."

WEDNESDAY, SEPTEMBER 25.

Builders' Foremen and Clerks of Works' Institution.—Quarterly meeting of the Directors, 8.30 p.m.

SATURDAY, SEPTEMBER 28.

Association of Municipal and Sanitary Engineers and Surveyors.—Home Counties' District Meeting at Wimbledon. Mr. Santo Crimp will read a short paper on "Wimbledon and its Public Works," after which a visit will be made to the Sewage Farm.

The German National Monument to the late Emperor William.—On Sept. 4, the day fixed for sending in competitive designs for the national monument of the Emperor William, 144 works, including forty-seven models, were received at Berlin. An exhibition of the designs will be held after the jury have made their awards.

Miscellanea.

School Board Contracts.—Brief reports have appeared in some of the daily papers of one or two "meetings of Metropolitan builders" to protest against the action of the London School Board in merging the jobbing work at the Board schools, at present done by 143 small builders, into the hands of six large ones. According to the *Standard*, Mr. Barnes, one of the members of the London School Board, attended, and told the meeting that there were not more than ten members of the Board responsible for the change. It was done by a little side committee, sitting during the vacation; and when he was informed that one firm had been given the work of 150 schools he told the chairman of the Works Committee he had made a mistake. He believed in localisation in such matters rather than centralisation, and if the big firms did the work at what in some cases was bound to be a loss, depend upon it the value would be taken out in another way. So strongly did he feel the injustice of the matter, that he now offered to introduce a deputation from that meeting to the School Board. The Chairman (Mr. Lawrence Stevens, L.C.C.) said all the small builders were being paid what was due to them from the School Board, which, he supposed, meant dismissal; but if the contracts were signed with the large firms for the next twelve months, the small builders might agitate for the future. Mr. T. F. Stonelake, a late member of the Board, expressed the belief that the School Board had done that which was inimical to the interests of the ratepayers, because large builders at a distance could not do the work so cheaply as the men on the spot. It was finally resolved that the members of the meeting individually should wait upon their respective representatives at the School Board to lay the matter properly before them. Thanks to the speakers closed the proceedings, about which we should perhaps have been able to say more had we been asked to send a reporter to the meetings. For some reason best known to themselves, the promoters of the meetings did not extend this courtesy to us.

Re-decoration of the Gaiety Theatre.—From some particulars which have been sent to us, we learn that the proprietors of the Gaiety Theatre, feeling that the existing decoration and upholstery had become somewhat dull with the effect of time, called in Mr. Romaine-Walker, architect, to advise with them and suggest a new scheme of colour. It so happened that some two years or so ago the same architect had re-constructed a portion of the theatre, and adopted the Indian style. This has now been carried on throughout the whole auditorium. The present scheme of colour is white, turquoise-blue, and indigo. The greyish-white ground, with foliage and ornament in the two blues, are relieved at the lower part of the theatre with a little gold. The ceiling is a design of enclosing lines and pine ornament, the cove a series of upright Oriental ornament connected with a curved leaf, making a cusped fringing to ceiling. The spandrels of the arches are edged with a border to transform the effect of the Gothic arch as much as possible into the Indian, the spandrel being filled with a large Oriental ornament in the blue and white colouring. Feeling that the picture by Mr. H. S. Marks, R.A., which had become almost black with years, notwithstanding its many cleanings, did not fit in with this style of ornament or colouring, it has been carefully covered over with oiled paper and canvas, the latter being decorated, and can at any time be uncovered and the picture disclosed. The private boxes, &c., are papered with an Indian pattern paper in the same colouring, which is carried round the panels of circles and through the whole auditorium. The curtains, resters, seating and carpet are blues of the various shades, and being entirely new and so arranged as to come in with the general scheme of colour. The passages, staircases, corridors, &c., are treated in an entirely opposite key of colour. The walls are white, the dados and decoration in cerise, carpets, draperies, &c., all being in the same key. The vestibule lobby into stalls being some time back constructed in a light Louis Seize style, the decoration is carried out in the same style with salmon colour silk draperies, &c. The decorations, upholstery, and carpets have been executed by Messrs. Campbell Smith & Co., under the superintendence of Messrs. Romaine-Walker & Tanner, architects. The whole work has been carried out in the remarkably short space of fourteen days.

The Rating of Machinery.—An important and largely attended meeting of manufacturers from all parts of England was held last week at the Grand Hotel, Bristol (Mr. W. F. Fox, of Nottingham, in the chair), to consider the attempts which have been made to assess all kinds of machinery to the local rates, and to consult as to the steps which should be taken to protect the interests of all those affected. It was unanimously resolved that a national society for the exemption of machinery from rating be formed among the machinery users of the kingdom, for the purpose of assisting manufacturers to resist illegal and excessive assessments. It was also resolved to prosecute an appeal to the superior courts against the recent decisions of the Somersetshire Quarter Sessions in respect of the machinery in the mills in the Chard Union, and to promote a Bill in Parliament which shall declare the law and render it free from any doubt on the subject. Mr. Humphreys Davies, F.S.I., of London, was appointed Secretary, and arrangements were made for a thorough organisation of the affected interests throughout the country. Subscriptions were paid or promised amounting to upwards of 2,000*l.* The feeling of all those present was expressed strongly that the question was of great national importance, and that to rate machinery would be to place our manufacturers at a serious disadvantage in competing with foreign countries, as it would largely increase the cost of production here, while abroad no such imposts exist.

Insanitary Areas in Clerkenwell.—It is stated that Dr. Griffith, the Medical Officer of Health for Clerkenwell, has made representations to the London County Council of no fewer than fourteen localities which, in his opinion, are insanitary, and should be done away with. The newly-appointed authority are likely to have their hands full, and it will need some nice discrimination to distinguish between demolition which should be undertaken by the vestries and district boards, and for which, under Torrens' Act, no compensation is given, and the improvement of sanitary areas, which can only be effected by the London County Council under Cross's Act at considerable public expense. We trust the ratepayers will not begrudge the cost of the removal of these plague-spots from London. It cannot be expected that the errors of the past can be undone without some burden being cast upon the present inhabitants of the metropolis, but it behoves the Council to see that we in our time are not guilty of mistakes that a future generation will have to redeem, for London must have spent in health improvements already not far short of two millions, in addition to the amounts which have been expended by private householders.—*Lancet.*

The English Iron Trade.—The English iron market continues exceedingly strong, and there is a very fair amount of activity. There is a revival in pig-iron all round, consumers coming forward more readily. The Glasgow warrant market has been firmer this week than last, with prices advancing, and Scotch makers have again advanced their quotations, some of the brands being as much as 3s. a ton dearer than last week. Middlesbrough pig has moved up 3d. a ton. Rates of Lancashire and Midland pigs are stiffer. It is only in north-west hematites that a relapse has taken place, the price of mixed numbers having dropped from 57s. 6d. to 55s. 3d. A considerable rise has taken place in old materials. Finished iron continues in active demand, and prices are very stiff. The previous activity of trade and hardness of values are maintained in steel. Shipbuilders are still very busy while booking fresh orders. Engineering establishments keep fully employed.—*Iron.*

Proposed Forth and Clyde Canal.—Some of the Scottish newspapers appear to be alive to the fact that this is a subject that it is worth while appearing to know something about. The *Scottish Leader* last week, after alluding gracefully to the fact that the *Builder* had some time ago drawn attention to the subject, proceeds to annex a considerable portion of one of our former articles, word for word, as its own: a proceeding complimentary to us, no doubt, but not very creditable to the *Scottish Leader*.

The Sanitary Institute.—Under the auspices of this Institute, a Health Exhibition and Congress are to be opened at Worcester on Tuesday next.

Lady Jones.—The widow of the late esteemed City Architect, Sir Horace Jones, died suddenly, a few days ago, at Dieppe, where with her little daughter she was spending the holidays. Lady Jones, who was fifty years of age, was (according to the *City Press*), the daughter of Mr. Patch, an eminent conveyancer of bygone days, and was an amiable, unostentatious lady, and her death will be deplored by many attached friends. We learn that the remains were interred in the family vault, by the side of the late Sir Horace, at Norwood Cemetery on the 11th inst. Amongst those present at the grave were Mr. Octavius Hansard, F.R.I.B.A., and Sir John B. Monckton, Town Clerk of London.

Land Sale in Kent.—We understand that "Meopham Court," the property of Mr. J. W. Crookes, has been sold by Messrs. Osborn & Mercer, of London, with about 436 acres of land, to Mr. Ralph Tweddell, who has for some time past been renting "Provender," near Faversham. The Meopham Court Estate comprises about 1,350 acres, and about 170 acres of building land adjoining or near to the station at Meopham, are going to be offered by auction at Gravesend, on October 9, in small lots of 2 acres and upwards. The remainder of the estate, we are informed, will be retained by Mr. Crookes.

What Becomes of the Pins?—As a suggestive indication of the number of pins brought in the ordinary course of trade into the City of London and there distributed throughout the world, we may mention that one wholesale house placed an order with a Stroud firm this season for six tons weight of these useful little articles.—*Warehousemen and Drapers' Trade Journal.*

Clown and Barlborough Sewerage.—The Worksop Rural Sanitary Authority have instructed Mr. W. H. Radford, C.E., of Nottingham, to prepare schemes for the sewerage and sewage disposal of Clown and Barlborough.

PRICES CURRENT OF MATERIALS.

TIMBER.	£.	s.	d.	£.	s.	d.
Greenheart, B.G. ....ton	7	0	0	7	15	0
Teak, E.I. ....load	12	0	0	14	0	0
Sequois, U.S. ....foot cube	0	2	3	0	3	0
Ash, Canada ....load	3	10	0	5	0	0
Birch "	3	10	0	6	0	0
Elm "	4	0	0	5	0	0
Fir, Dantsic, &c.	2	0	0	3	10	0
Oak "	2	10	0	4	10	0
Canada	5	10	0	7	10	0
Pine, Canada red	3	0	0	4	0	0
" yellow	3	10	0	5	5	0
Lath, Dantsic ....fathom	4	10	0	5	10	0
St. Petersburg	5	0	0	8	10	0
Wainscot, Riga, &c. ....log	2	15	0	4	5	0
Deals, Finland, 2nd and 1st...std.	100	9	0	0	11	0	0
" " 4th and 3rd....		7	0	0	8	15	0
Riga		7	0	0	9	0	0
St. Petersburg, 1st yellow		11	0	0	15	0	0
" 2nd "		10	0	0	11	0	0
" white		7	0	0	10	0	0
Swedish		8	0	0	16	0	0
White Sea		9	0	0	17	0	0
Canada, Pine, 1st		16	0	0	36	0	0
" " 2nd		11	0	0	17	10	0
" " 3rd, &c.		8	0	0	10	10	0
" Spruce, 1st		9	0	0	11	0	0
" " 3rd and 2nd		7	0	0	9	0	0
New Brunswick, &c.		8	10	0	8	10	0
Battens, all kinds		6	0	0	18	0	0
Flooring Boards, sq., 1 in., prepared, First		0	11	0	0	14	0
Second		0	8	0	0	10	6
Other qualities		0	5	6	0	7	9
Cedar, Cuba ....foot		0	0	4½	0	0	5
Honduras, &c.		0	0	4½	0	0	4½
Mahogany, Cuba		0	0	4½	0	0	6½
St. Domingo, cargo average		0	0	4½	0	0	6½
Mexican "		0	0	4½	0	0	5½
Tobasco "		0	0	5½	0	0	6½
Honduras "		0	0	5½	0	0	6½
Box, Turkey ....ton		4	0	0	13	0	0
Rose, Rio		15	0	0	20	0	0
Bahia		14	0	0	18	0	0
Satin, St. Domingo ....foot		0	0	6	0	1	0
Porto Rico		0	0	2	0	1	3
Walnut, Italian		0	0	4½	0	0	6½

METALS.						
IRON—						
Pig, in Scotland .... ton		0	0	0	0	0	0
Bar, Welsh, in London		6	0	0	6	5	0
" " at works in Wales ...		5	10	0	6	0	0
" Staffordshire, in London ...		7	0	0	7	10	0
COPPER—						
British, cake and ingot.... ton		47	10	0	0	0	0
Best selected		48	10	0	0	0	0
Sheets, strong		56	0	0	0	0	0
Chili, bars		43	0	0	0	0	0
YELLOW METAL....lb.		0	0	5	0	0	5½
LEAD—						
Pig, Spanish....ton		12	12	6	0	0	0
English, com. brands		12	12	6	12	15	0
Sheet, English		14	0	0	0	0	0
TIN—						
Banca ....ton		93	0	0	0	0	0
Billiton		92	0	0	0	0	0
Straits		90	5	0	0	0	0
Australian		90	5	0	0	0	0
English Ingots		95	0	0	0	0	0
Bars		98	0	0	0	0	0
Refined		97	0	0	0	0	0
ZINC—English sheet ....ton		24	0	0	24	10	0

OILS.	£.	s.	d.	£.	s.	d.
Linseed ....ton	21	12	6	21	17	6
Cocoanut, Cochin	27	10	0	28	10	0
Ceylon	24	10	0	0	0	0
Palm, Lagos	28	0	0	0	0	0
Rapeseed, English pale	32	0	0	0	0	0
" brown	30	15	0	0	0	0

OILS (*continued*).	£.	s.	d.	£.	s.	d.
Cottonseed, refined	27	0	0	0	0	0
Tallow and Oleine	21	0	0	40	0	0
Lubricating, U.S.	5	0	0	6	0	0
" refined	7	0	0	12	0	0
TAR—Stockholm ....barrel	1	5	0	0	0	0
Archangel	0	15	9	0	16	0

COMPETITION, CONTRACTS, & PUBLIC APPOINTMENTS.

Epitome of Advertisements in this Number.

COMPETITION.

Nature of Work.	By whom Required.	Premium.	Designs to be delivered.	Page.
Board School	Burnley School Board	Not stated	Nov. 14th	ii.

CONTRACTS.

Nature of Work, or Materials.	By whom Required.	Architect, Surveyor, or Engineer.	Tenders to be delivered.	Page.
Laying Water Mains	Epsom Local Board....	*Official*	Sept. 23rd	xiv.
Roadmaking and Paving Works	Willesden Local Board	O. Claude Robson	Sept. 24th	xiv.
Widening Bridge, &c.	Stockport County Boro'	A. M. Fowler	Sept. 26th	ii.
Erection of Visitors' Room, Ashford School...	West Lond. Sch. Dist.	*Official*	Sept. 27th	ii.
New Coastguard Station, Deal	Admiralty	do.	do.	ii.
Superstructure of Lunatic Asylum	London County Council	G. T. Hine....	Sept. 28th	xiv.
Enlargement of Lunatic Asylum, Coulsdon ...	do.	C. H. Howell	Sept. 30th	xiv.
Completion of Passages on Estates....	Tooteth Park Loc. Bd.	John Price....	do.	xiv.
Heating Apparatus	Chelsea Public Libraries Commissioners	*Official*	do.	xiv.
Sewerage and Sewage Disposal Works	Bingley Local Board ...	A. E. Preston	do.	ii.
Storage Reservoir, &c.	Yeadon Water Co.	do.	do.	ii.
Street-Making Works	Southend Local Board	P. Dodd....	Oct. 1st	xiv.
Engine and Deep Well Pump	Hackney Union	*Official*	do.	xiv.
Extension of Workhouse Laundry and Kitchen	Chelsea Guardians	do.	do.	xiv.
Waterworks....	Market Harborough, &c., Local Board	J. B. Everard	do.	ii.
Erection of Baths, Plumbing Works, &c.	St. Helen's Corporation	G. J. C. Broom	Oct. 2nd	ii.
Broken Blue Guernsey Granite	Romford Local Board...	*Official*	Oct. 5th	xiv.
Stables	Southampton Corp.....	W. B. G. Bennett	Oct. 8th	xiv.
Women's Workroom, Harrow-rd. Workhouse	Paddington Guardians	A. & C. Harston	do.	xiv.
Broken Guernsey Granite	Grays Thurrock L. B.	*Official*	do.	xiv.
Sewerage and Sewage Purification Works.....	Kingston R. S. A.	W. H. Hope	Oct. 9th	xiv.
School and Outbuildings, &c., Guildford	The Committee.....	.....	Oct. 12th	xiv.
Sewage Disposal Works, Deighton	Huddersfield County Boro'	R. S. Dugdale	Not stated	xiv.

PUBLIC APPOINTMENTS.

Nature of Appointment.	By whom Advertised.	Salary.	Applications to be in.	Page.
Clerk of Works	Market Harborough, &c., Local Board	3*l.* per week	Sept. 24th	xix.
Clerk of Works	River Cam Bridges Committee	Not stated	do.	xix.
Assistant Clerk, Borough Engineer's Office...	Keighley Corporation...	do.	Sept. 30th	xix.
Road Foreman	Handsworth Local Bd.	2*l.* per week	Not stated	xix.

TENDERS.

[Communications for insertion under this heading must reach us *not later than* 12 *Noon on Thursdays.*]

BROMLEY (Kent).—For additions to "The Dargle," Bromley, Kent, for Mr. R. G. Mullen. Mr. John Ladds, architect, 4, Chapel-street, Bedford-row, London, W.C.:—

Caplen & Redgrave, Croydon*	£155 5 0

* Accepted.

BROMLEY (Kent).—For 900 ft. lineal of 9 in. stoneware pipe sewer, with manholes, &c., in Magpie Hall-lane, for the Bromley Local Board. Mr. Hugh S. Cregeen, surveyor:—

W. & J. Woodhams....	£111 0 0
E. Pelll & Sons....	98 0 0
T. Lansbury (accepted)....	78 0 0

CROYDON.—For painting at the Union Infirmary, Mayday-road, Croydon, for the Guardians. Mr. F. West, architect, Coombe-road, Croydon. Quantities not supplied:—

Cox & Woolard, Thornton-heath	£1,270 0 0 !
Joscelyne & Yoring, Borough, S.E.....	994 0 0
D. W. Barker, Croydon	930 0 0
A. Barton, Sydenham....	849 0 0
F. P. Marwood & Co., West Kensington	799 0 0
Smith & Sons, South Norwood	777 0 0
E. Scase, Surbiton-hill	730 0 0
Hammond & Son, Greenwich	660 0 0
H. Fullager, Kingsland-road	614 0 0
T. E. Dartnell, Croydon	603 0 0
G. R. Bryan, South Norwood	597 0 0
M. Batchelor, East Maidstone....	590 13 0
F. J. Wicks, Willesden Park	570 0 0
G. Withers, Camberwell	567 5 0
C. W. Fox, Anerley-road	567 0 0
W. J. Penfold, Upper Sydenham	559 17 0
C. Shaw, Lavender-hill	550 0 0
W. F. Hadlord, Dover	549 0 0
Gardner & Llewellyn, Croydon	536 10 0
Blackmore, Craker, & Co., Croydon ...	532 14 0
J. C. Hunt, Southsea	506 0 0
W. G. Lilly, Whitcombe-street, W.C.	479 0 0
Akers & Co., South Norwood	475 0 0
W. Beadle, Penge	448 0 0
J. Hole, Sutton	438 0 0
Barber & Oliver, Hove, Sussex	399 0 0
W. & P. Hards, Croydon	390 0 0
Stewart & Co., Walworth	342 0 0
J. C. Fuller, Lee-road	334 0 0 !

COLCHESTER.—For building new billiard-room, for the Colchester Conservative Club. Mr. J. W. Start, architect, Colchester:—

J. Grimes, Colchester	£240 0 0
A. Baker, Colchester	231 5 0
T. J. Ward, Colchester (accepted) ...	220 0 0

EAST HAM (Essex).—For the erection of fourteen cottages, for Mr. H. Howard:—

Burgess & Algar, Bromley, E.....	£2,100 0 0

[No competition.]

EGHAM.—For two houses and shops, for Mr. J. Powell. W. Menzies, architect:—

Dicks, Egham	£547 0 0
G. Reavell, Staines....	525 0 0
W. Gray, Egham....	489 0 0

LEYTON.—For paving with Victoria stone the following roads, viz., Millais, Frith, Calderon, Ramsay, Trumpington, Thorpe, Melbourne, Broxbourne, Selby, Ranelagh, Chelmsford, Oakdale, Queen's, Cranbourne, Etchingham, Nutfield, Westdown, Alexandra, Worsley, and Cary roads, for the Leyton Local Board. Mr. Wm. Dawson, A.M.I.C.E., Surveyor:—

Paving, Kerbing, &c.	
W. Farrar	£8,407 9 9
Nowell & Robson	7,892 7 5
Victoria Stone Company	7,810 2 3
Wm. Griffiths (accepted)	7,503 18 1
J. Mowlem & Co....	7,752 2 3
Roadmaking.	
J. S. Jackson (accepted)	1,760 0 0
J. Reeves	1,579 10 4
Eli Wilson....	1,893 6 1
Wm. Griffiths	1,820 8 0
W. G. Harris	1,889 2 10

LONDON.—For alterations at the "Camden Head," Bethnal Green-road. Mr. R. A. Lewcock, architect, 88, Bishopsgate-street Within:—

A. Hood (accepted)....	£1,759 0 0

LONDON.—For alterations at "The George and Dragon," Cleveland-street, Fitzroy-square. Mr. R. A. Lewcock, architect, 88, Bishopsgate-street Within:—

Jackson & Todd	£574 0 0
Walker	527 0 0
Hayworth	521 0 0
Spencer & Co.	515 0 0
Stephenson	498 0 0
Ivory	495 0 0
Davies (accepted)	450 0 0
Gasfitter.	
Winn (accepted)....	£150 0 0

LONDON.—For the erection of new Mission Church of St. Frideswide, Fillett-street, East India Dock-road, E., for the Christ Church Oxford Mission. Mr. R. Willey, architect, 66, Ludgate-hill, E.C.:—

Burman & Sons	£4,209	0	0
Woodward & Co.	4,114	0	0
Smith	3,975	0	0
Martin, Wells, & Co.	3,780	0	0
Holland (accepted)	3,600	0	0

LONDON.—For hall, billiard-room, dressing-rooms, &c., for the Holborn Gladstonian Club, Devonshire-street, Theobald's-road, W.C. Messrs. Vinter & Holland, architects, 3, Little George-street, Westminster, S.W.:—

Kellaway	£1,350	0	0
Banks	897	0	0
Laing & Son	868	0	0
Wells & Sons	865	0	0
Young & Lonsdale (amended)	803	0	0

LONDON.—For alterations at the "Pitt's Head" public-house, Goswell-road, E.C., for Mr. M. Levy:—

Hawkins	£114	0	0
Wilson	110	0	0
Kellaway	107	0	0
Burgess & Algar, Bromley, E.*	91	10	0

* Accepted.

LONDON.—For rebuilding granary at Rotherhithe-street, S.E., for Mr. W. A. Fisher. Mr. A. R. Stenning, architect. Quantities by Mr. Edwin Crockett:—

Jennings	£1,207	0	0
Kirk & Randell	1,184	0	0
Lea	1,041	0	0
J. & J. Greenwood	976	0	0
A. White & Co.	939	0	0
Sabey & Son, Islington	900	0	0

LONDON.—For erecting St. Columb's Parochial Hall, Notting Hill, for the Rev. Canon Trench. Mr. E. P. Loftus Brock, F.S.A., architect:—

Mark	£484	0	0
Dessham	445	0	0
Kynoch & Co.	420	0	0
Tozer	416	0	0
Bowden (accepted)	359	0	0

LONDON.—For alterations at "The Marquis of Clanricarde," Southwick-street, Paddington. Mr. R. A. Lewcock, architect, 88, Bishopsgate-street Within:—

Spencer & Co. (accepted)	£950	0	0
Pewterer.			
Heath (accepted)	114	0	0
Gasfitter.			
Steadman (accepted)	45	0	0

LONDON.—For alterations at "The Prince of Wales" tavern, Old-street, St. Luke's. Mr. R. A. Lewcock, architect, 88, Bishopsgate-street Within:—

Spencer & Co. (accepted)	£730	0	0

LONDON.—For works at "The Windsor," 427, Strand. Mr. R. A. Lewcock, architect, 88, Bishopsgate-street, Within:—

Gasfittings.			
Winn (accepted)	£310	0	0
Pewtering and Counters.			
Heath (accepted)	355	0	0

LONDON.—For supplying and fixing wainscoat oak panelling on staircase and hall at 19, Green-street, Park-lane, for Mr. J. W. Malcolm. Mr. J. A. Stenhouse, architect:—

C. Hindley & Sons (accepted)	£230	0	0

NOTTINGHAM.—For supplying and laying oak, &c., parquet floors at Lincoln-circus, The Park, Nottingham, for Mr. T. Hill. Mr. J. A. Stenhouse, architect:—

C. Hindley & Sons (accepted)	£250	0	0

READING.—For proposed Mission Hall and class-rooms, Oxford-road, Reading. Messrs. Rumble & Knight, architects, Town-hall Chambers, Reading. Quantities supplied by Mr. J. Rookwood, 33, Argyll-street, London, W.:—

Castell	£1,480	0	0
Goodchild	1,360	0	0
Cook	1,359	0	0
East	1,256	0	0
Bottrill	1,240	0	0

UPTON PARK (Essex).—For the erection of villa residence, for Mr. Jas. King:—

Perry	£630	0	0
Burgess & Algar	610	0	0
Butler (accepted)	607	0	0

WILLESDEN.—For erecting three private houses at Willesden, for Mr. Roscoe:—

Cowley & Drake (accepted)	£1,000	0	0

WILLESDEN.—For new workshops, stores, &c., at Willesden, for Messrs. Taylor & Tucker. Mr. Stokes, architect, Broad-street, E.C.:—

Cowley & Drake, Willesden Green, N.W. (accepted)	£1,120	0	0

WIVENHOE (Essex).—For new schools, residences, board room, &c., for the Wivenhoe School Board. Mr. J. W. Start, architect, Colchester:—

Mackenzie, Clacton-on-Sea	£12,889	0	0
Runnacles, Halstead	10,753	0	0
Saint & Son, St. Ives	10,550	0	0
Diss, Colchester	10,163	0	0
Coe, Ipswich	10,058	0	0
Grimwood & Son, Sudbury	9,983	0	0
Ellwood & Son, Sandy, Beds	9,595	0	0
Orfem, Colchester	9,095	0	0
Dupont, Colchester	8,593	0	0
W. J. Day, Clacton-on-Sea	6,804	0	0

WOODFORD.—For the erection of a house at Woodford, for Mr. H. Fish. Mr. E. C. P. Hodgkinson, architect, 22, Wellington-street, Strand. Mr. B. Swinstead, surveyor, 22, Wellington-street, Strand:—

Boyce	£2,940	0	0
Wall Bros.	2,879	0	0
Pocock, Wood-green (accepted)	2,633	0	0

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